THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1772.] LONDON, APRIL 27, 1897. [49TH YEAR. PRICE 6d.

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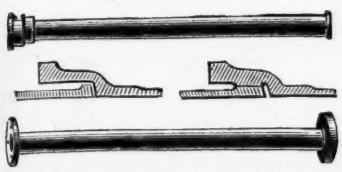
1¼ to 12 IN. BORE.



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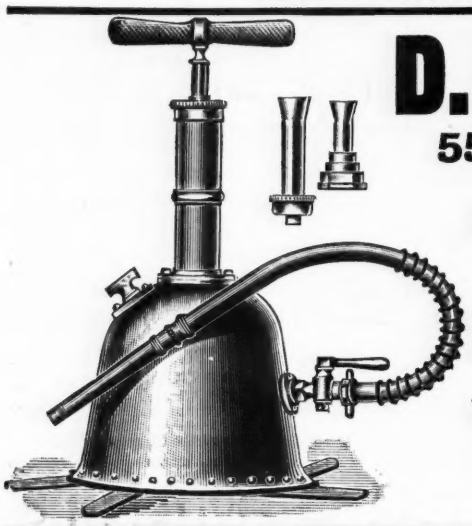

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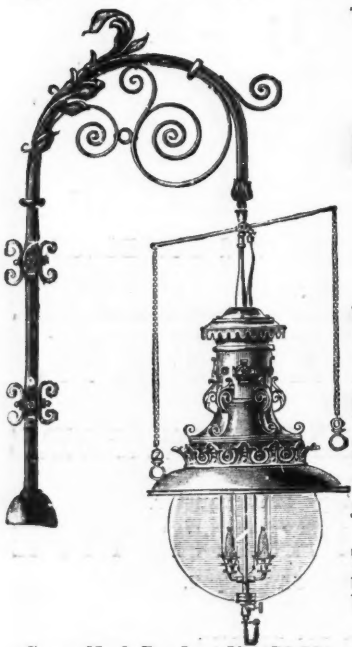

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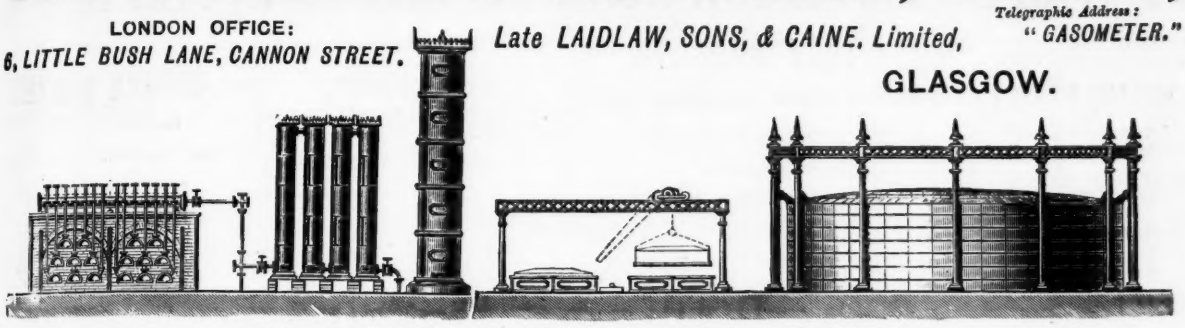

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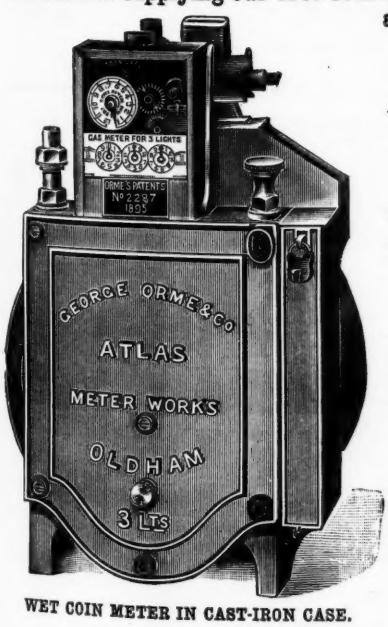

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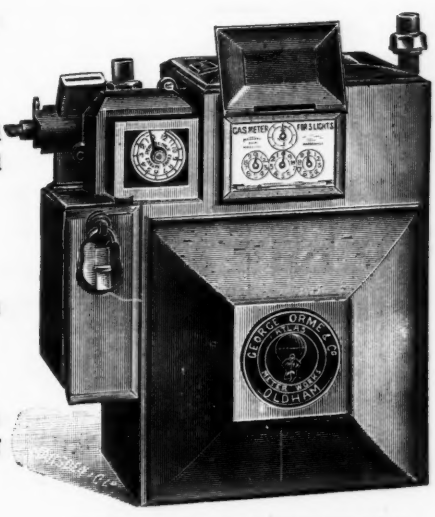

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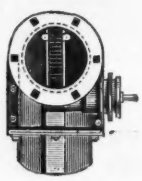

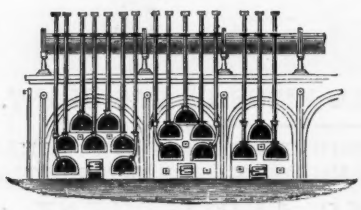

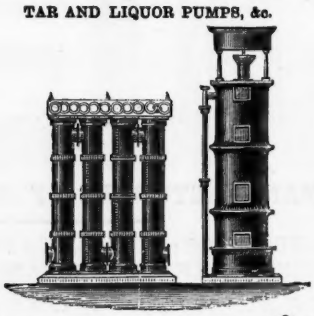

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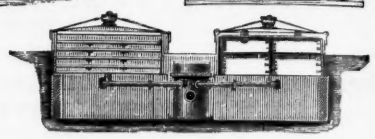

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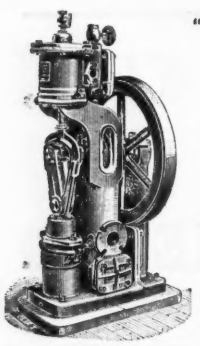

Fig. 703. "SINGLE RAM" STEAM-PUMP.

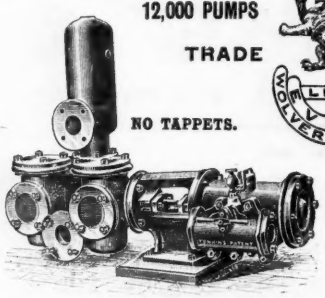

Fig. 568. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

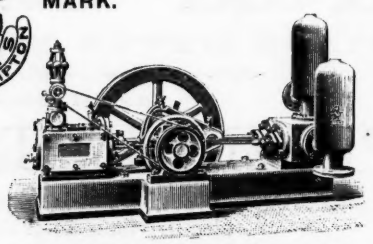

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

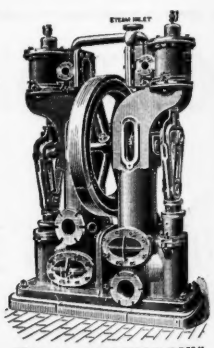

Fig. 712. "DOUBLE-RAM" STEAM-PUMP

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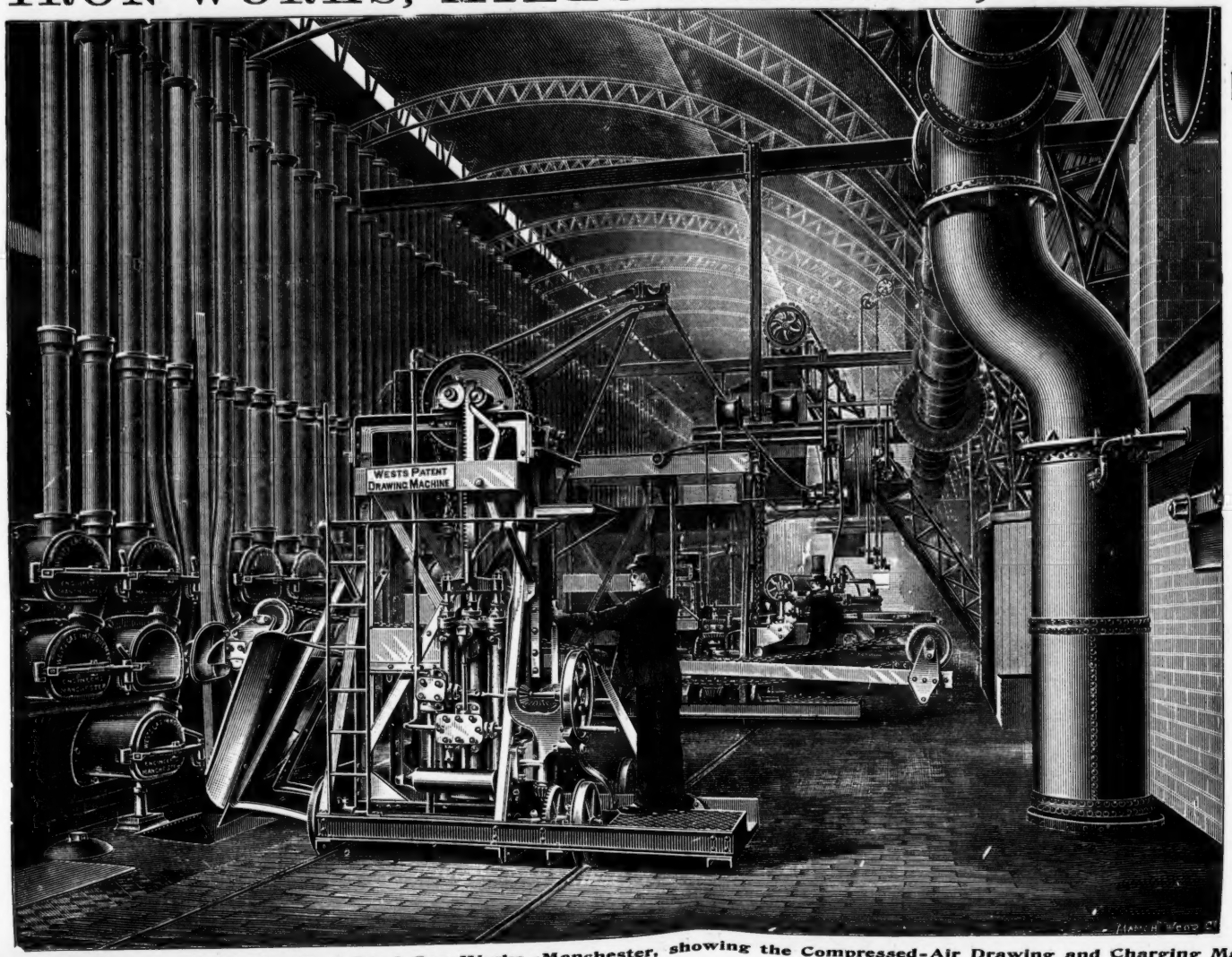

Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

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RETORTS DAILY

ARE CHARGED AND DRAWN BY

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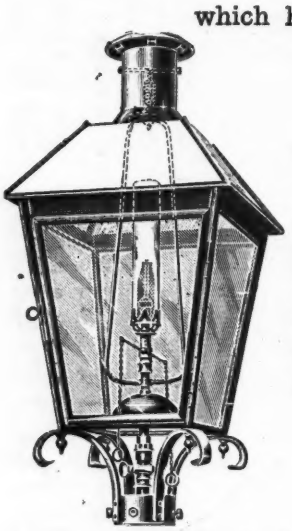
INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of



STREET LIGHTING,

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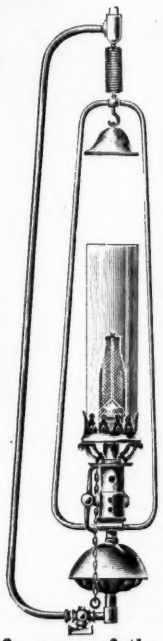

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"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

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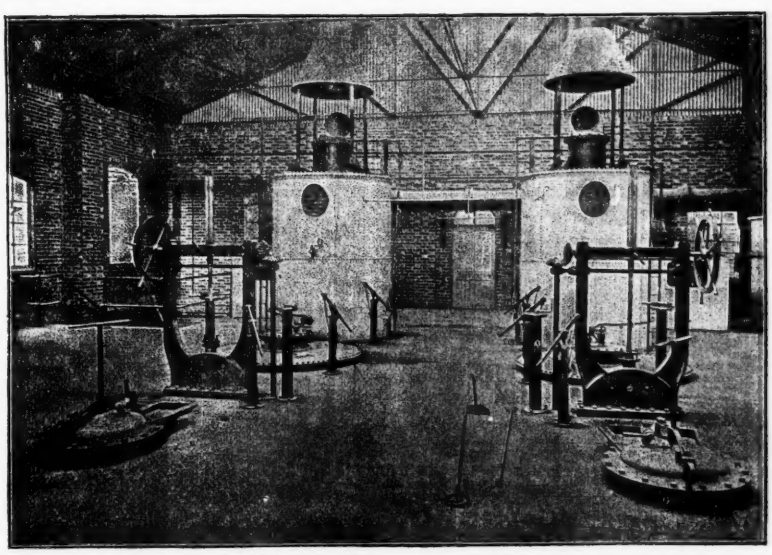

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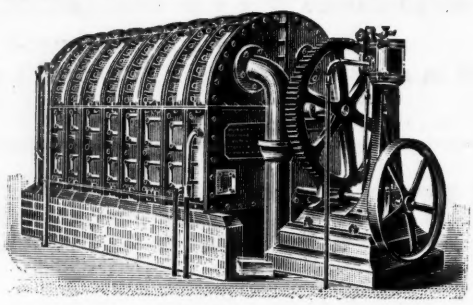

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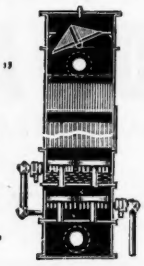

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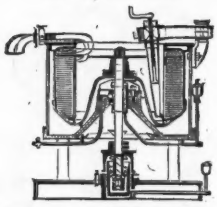

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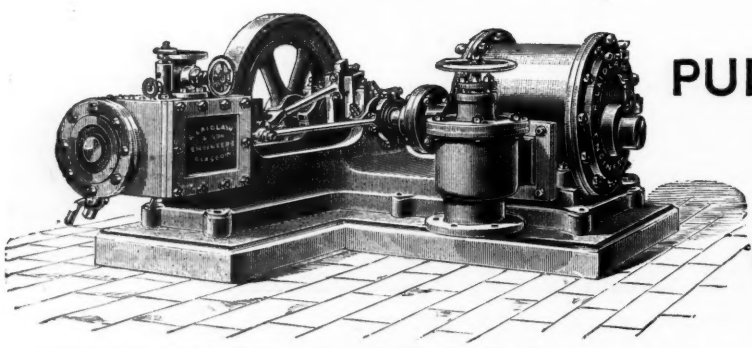

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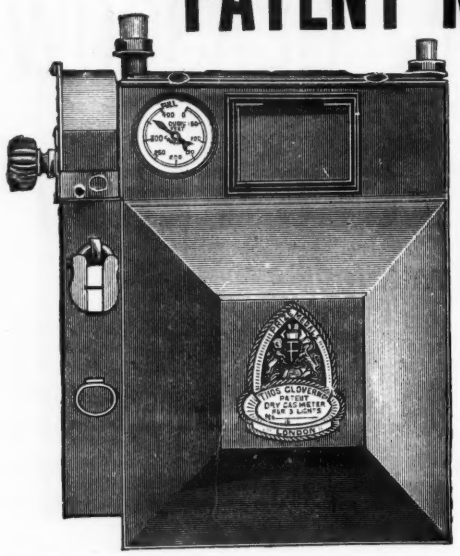

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EDITORIAL NOTES.

Two District Association Meetings.

As will be seen from reports published in another part of the "JOURNAL," two District Associations of Gas Managers held meetings last week. The Eastern Counties Association met in Peterborough on Wednesday, when the retiring President, Mr. A. Drage, of East Dereham, was succeeded in the chair by Mr. J. T. Jolliffe, of Ipswich, who delivered an interesting Inaugural Address. The visitors were welcomed to the city by Mr. W. Harris, the Chairman of the Peterborough Gas Company; and the gathering, though small in numbers, was successful in other respects. Besides the President's Address, the business of the meeting included the postponed discussion on Mr. R. G. Shadbolt's paper on "The Self-Enrichment of Coal Gas." This was opened by Mr. Shadbolt himself, who very appropriately gave a *résumé* of his original contribution, so as to remind the meeting what it was that awaited discussion. It may be suggested that this precedent might be generally followed when debateable papers are brought before District Association meetings. The time at the disposal of such assemblies is ordinarily too short to permit of both the reading and the full discussion of a substantial paper; and the usual way of dealing with technical compositions of this character is consequently at best a choice of evils. Either the reading has to be slurred over, which is unfair to the author and hardly respectful to the audience; or the discussion has to be postponed to a subsequent meeting, when it is found difficult to "warm up" the interest. On the other hand, postponement may be positively advantageous when, as in the case in point, lapse of time enables the author to round off his communication by adding to it whatever confirmatory of the critical observations further experience may suggest. Mr. J. Barton, of Peterborough, also gave the meeting an account of the manner in which he had dealt with an unexpected visitation of naphthalene, the cause of which he was not prepared to explain. Mr. Chester, of Nottingham, capped this moving tale with an analogous experience of his own; thus exemplifying one of the reasons that cannot be too prominently kept in mind for the existence of these professional gatherings.

The members of the North of England Gas Managers' Association met at Newcastle-upon-Tyne on Saturday, when the President, Mr. J. H. Penney, of South Shields, took the opportunity of giving a short supplemental address dealing with one or two topics of the day. The recrudescence of labour troubles at several gas-works in this part of the world has supplied Mr. Penney with an occasion for declaring his adhesion to the policy of Mr. George Livesey. He does this in a most uncompromising fashion; and as gentlemen in his position are not in the habit of talking at large on subjects of such importance without meaning business, it is to be expected that we shall hear in due time of an extension in practice of the system of which Mr. Penney so warmly approves. The position of sulphate of ammonia and the puzzle of gas-works assessment were also touched upon in this short, but pregnant address. A feature of the meeting was the presentation of a testimonial to Mr. W. Hardie, one of the founders of the Association, who retires from the position of Honorary Secretary and Treasurer after a long period of devoted service. Mr. Penney was elected to Mr. Hardie's old office.

Labour Trouble at Leeds.

THERE has been serious trouble at the Leeds Corporation Gas-Works in connection with the introduction of machine stoking. Several notices of the growth of the spirit of dissension between the Corporation Gas Committee and the retort-house men have appeared in the "JOURNAL" of late, and, as appears from the long story we publish to-day, matters came to a climax last Thursday, when a number of men struck against new rules which were to have been put into operation on that day. The introduction of machine stoking has naturally involved a radical change in the conditions of work in and about the Leeds retort-houses; but the Committee have tried to make the alteration as little obnoxious as possible to their old hands. With this view, they have endeavoured to convert many hand stokers into machine attendants, not with conspicuous success. These men have not done so well with the machines as has been done elsewhere; and the Committee do not see why, in the interests of the town, they should put up indefinitely with

this probably calculated inefficiency. Consequently, a new set of working rules has been framed and posted in the works for this month past, so that the men should have ample warning of what was expected of them. It is not surprising to learn that the local officials of the Gas Workers' Union did not like these new rules at all. They would have preferred to have nothing to do with machine stoking; but as it would hardly have served their purpose to quarrel with the Committee fairly and squarely upon this issue, they took the middle course of finding fault at the last moment with the details of the rules. On Thursday morning, the malcontents took the definitive step of sending a deputation to the Works' Manager at New Wortley (Mr. Bond), to ask whether the new rules were to be actually enforced; and upon being answered in the affirmative, the deputation retired, and called off as many of the men—about 130 in number—as would obey their behest. The consequences of this performance are not very difficult to forecast. A sufficient number of men remained to keep the fires going and work the machines after a fashion; a small contingent of clerks aiding, under the acting supervision of Mr. R. H. Townsley (the General Superintendent) and Mr. Bond, in doing the necessary duty of maintaining the manufacture of gas.

The local public cannot be ignorant of the truth that the issue between the Gas Committee and the local branch of the Gas Workers' Union is as to which shall manage the undertaking. Once more, there is no question here of "recognition of the Union," upon which gas stokers have struck before now, inasmuch as the Town Clerk writes most polite letters to the local officials of the Union, and the Committee are quite willing to receive these gentlemen as part of a deputation of their own workmen. The event shows how futile is the expectation that any amount of complaisance in this direction will avail to avert an illegal strike of gas workers. The New Wortley men simply "downed tools" and took themselves off to hold a strike meeting and arrange for picketing the scene of their late employment, just as if they had been the victims of an arrogant capitalist's base attempts to subvert the sacred principle of Trade Unionism. The Leeds Gas Committee are very patient to bear with the vagaries of men whom they wish to consider in all legitimate ways as fellow-citizens; but their first duty is to the ratepayers and the gas consumers. It is impossible for them, as employers, to submit to have every improvement in the manufacture nullified in the supposed interest of a handful of displaced stokers. If the Committee had cleared out the hand stokers, and manned the new machines with suitable attendants imported for or trained to the fresh order of things, they would have had ample economic excuse for so doing. In mercy, however, to the old hands, they tried to let them down gently, and find such work for them as they might be able to do; and their reward is a strike. The lesson is to be commended to those callow theorists who would have the world believe that, with the general recognition of Trade Unions and the universalization of Municipalism, labour troubles would cease from the land. The one bright spot in the wretched affair is the dutifulness of the staff. The end is quite certain. The insensate attempt to coerce the Leeds Gas Committee by depriving the city of gas will fail; and the New Unionism will stand convicted of one more piece of folly and foiled tyranny.

After the foregoing was written, news reached us to the effect that the strikers had thought better of it, and decided to resume work under the new rules. As a newspaper report has it: "They have agreed to try the experiment "whether the amount of work prescribed in the new rules "drawn up by the Gas Committee can be accomplished "with reasonable ease." We have little doubt that they will find the Committee have no desire to overwork them. When it comes to the Leeds men being asked to do the same amount of work with stoking machinery that is accomplished easily enough elsewhere, they must either do it or confess inferiority, to which alternative they will probably be loth to descend. Meanwhile, we may be permitted to express surprise at the easy way in which the Committee, and the public generally—so far as the local newspapers can be assumed to represent public opinion—have taken the revolt. The newspapers have calmly reported the men's doings just as if they had a perfect right to imperil the supply of gas to the city at their own sweet will. Where, one may ask, was the Act of Parliament which is supposed to protect the community from this danger? Does it not apply to Leeds? The possibility of proceedings being taken against the strikers has never, so far as we are aware, even been mentioned in the local comments upon the occurrence. The Leeds Gas Committee should remember that they are not entitled to play fast and loose with the means provided by the Legislature for safeguarding the gas supply of communities. Yielding to the forces of anarchy is not a safe policy, either in Leeds or elsewhere.

The Affairs of the Paris Gas Company.

In another column will be found an abstract translation of the report of the Directors of the Paris Gas Company, with the principal figures of the accounts for the past year's working of the undertaking. It is satisfactory to learn from these that Paris exhibits in full proportion that increased capacity for consuming gas which has been so marked a characteristic of the past year all the world over. The growth of the number of gas consumers in Paris is even more rapid than the expansion of the gas consumption; and it testifies to the efficacy of the liberal measures recently adopted by the Company to extend the benefits of gas among the population. When it is stated that nearly one-fifth of the total number of consumers on the books of the Company have been entered during the last two years, enough is said to prove the vitality of the undertaking and the activity of the administration. An addition of 2947 public lamps for the year also shows that Paris is far from being tired of gas lighting. Reference in the Directors' report to the ever-growing demand for gas supplied by means of what are called "rising mains" again points in an interesting fashion to what has become a conspicuous feature of Parisian domestic life. Paris is yearly becoming more and more a city of tenement dwellings; and the Gas Company are making every effort that commends itself as expedient to meet the necessities of the population. Thus, two years ago the Directors decided that they would lay on gas free of charge, without meter-rent, to all tenement occupiers paying less than £20 a year rent whose landlords had nothing against them. Those who know how hardly the conditions of life in Paris bear upon the poorer order of occupiers will appreciate the considerateness of this policy, which has been taken advantage of by no fewer than 71,830 consumers. There are other matters in the report well deserving the closest attention of English readers.

Mr. Courtney on Private Bill Legislation.

Mr. Leonard Courtney, M.P., has been speaking at Plymouth on the work of the Houses of Parliament. Though Mr. Courtney sits in the House of Commons for a Cornish constituency, he is generally understood to really represent Uncompromising Rectitude in the conduct of public affairs. In the latter capacity, he told the Plymouth Chamber of Commerce a few days since that the less such institutions have to do with the Legislature, or the Legislature with them, the better. He described as the most praiseworthy part of the work of Parliament during the last fifty or sixty years, that which has been accomplished in the direction of setting people free to do what they desire to do in the way of business. For instance, when the Legislature allowed more than six persons to form a partnership, which at one time was illegal at common law, it was simply giving them the freedom that did more for commerce and trade than any possible enactment it could lay down. Even now, the speaker went on to remark, the Legislature might do something more, in the way of setting people free from dependence upon the Legislature itself. He meant to say that, in his opinion, the best thing that could be done for industry and commerce in this country at the present time would be to get removed from Parliament the Private Bill Legislation that now exists. "If they wanted in any locality to associate themselves "together for some purpose which required extraordinary "powers; if they wanted to make a railway, or to get more "powers for the municipality to acquire gas-works, or to "carry out any other undertaking, they had now to go before "two consecutive Committees of the two Houses of Parliament; the whole work being crammed into a few hurried "weeks, and much expense and labour being involved." The remedy suggested by Mr. Courtney was the familiar one of a permanent tribunal, which should send one of its members to the locality concerned, "who would hear "the facts on each side, and make a report to his fellow

"members if there was any opposition." In this way the public would get the benefit of skilled guidance without the trammels of the present system. "There would be "comparative freedom from expense; and enterprises "which are now thwarted would be successfully produced "and promoted." Sir E. Clarke agreed that it is a great hindrance to the development of municipal institutions and to the carrying forward of great industrial affairs in this country that there should be the cumbrous, extremely expensive, and to a certain extent hap-hazard system of Private Bill Committees as they are now constituted. He concurred with Mr. Courtney in urging upon the Chambers of Commerce that they should turn their attention to the subject, and make efforts to bring about the establishment of some tribunal to take the place of the present unsatisfactory one. We have heard many such counsels, and have ceased to expect anything from them. Everybody can find fault with the existing Private Bill system; but nobody has yet succeeded in devising a better. It is not as if the matter had to be gone into for the first time. Too many interests have now grown up round the settlements effected by Private Acts of Parliament to permit of these being set aside by any lower authority than that which sanctioned them. Most people would agree in spirit with Mr. Courtney and Sir E. Clarke in what they say about Private Bill Legislation; but how many people would consent to any arrangement for barring their own access to Parliament if they should happen at any time to have need to resort to this supreme authority? There is, moreover, still another side to the picture, which is referred to in an article by Mr. George H. Paine in last month's "Engineering Magazine." The writer here contrasts the reckless manner in which the making of railways was entered upon in the United States, with the "solid and rational method" of preliminary investigation into similar matters in England; and he concludes that all the expense of such inquiries has been saved many times over to the British public and the Railway Companies by the enlightened practice resulting from them. British gas companies and municipalities have paid high prices for their legislative privileges; but they are still able to sell the cheapest gas in the world, and return fair dividends and interest upon honest capital.

The Dispute in the Engineering Trade.

It is more to be regretted than wondered at that the recent protracted conference between the representatives of the Federation of Engineering Employers' Associations and the Amalgamated Society of Engineers should have failed to settle the difficulty of machine-minding employment. This was not the only question that occupied the delegates to the conference, for there were many other points of detail in respect of the regulation of hours of labour and men's allowances to be talked over; and it is satisfactory to know that all these matters were amicably disposed of, at any rate for the time being. Even with regard to the crucial question of what class of workman should have the tending of machine tools, there was no bitterness; but the conference broke up without effecting a settlement, simply owing to the inability of the two parties to see the matter from the same point of view. The men's representatives were asked to formulate their notion of how the difficulty might be got over by any means short of dictating to the employer the kind of machine tools he might have in the shop and the class of workmen who should look after them; but this they could not do. They thought that District Committees might be appointed, composed of equal numbers of employers and men, with power to call in an official arbitrator, to whom all these questions of the right of employment should be referable. This notion, however, transgressed the employers' fundamental requirement that there must be no interference with their shop management; and here the question rests. It has been the same from the beginning of the introduction of machine tools into engineering shops; and it will continue until the men are made or brought to see that all increase of the shop output is to their advantage. Unhappily, at every stage of the development of the engineering industry—from the days of the hammer and chisel down to the present—Trade Union prejudice has sought to interfere in the process in its own purblind interest. At first, owing to the imperfection of the mechanical arrangements, it took as good a workman to look after a self-acting machine as it did to do without it; but from the start this condition has been improved upon—always, however, in the teeth of Trade Union opposition. At bottom, the expert fitter is as bitterly opposed to the "iron man" as any gas worker, and as hard to persuade that he must give way whenever it appears to be a case of man *versus* machine. Trade Unionism will not see behind the machine the forces of capital, invention, and commercial aptitude; or, if it does, it is only to clamour for their abolition in the name of Socialism. What a curious delusion, that when there is no money, no invention, no trade, the working man will be happy—not before!

WATER AND SANITARY AFFAIRS.

Dr. Frankland's report on the Metropolitan Water Supply of 1896, as published in the "Annual Summary" of the Registrar-General, is not only as elaborate as the reports for former years, but even more so. Commencing with the chemical and physical examination of the water, attention is again drawn to the general chemical superiority of the Lea over the Thames as a raw material. But recognition is given to the great chemical improvement effected by the operations of the Companies drawing from the Thames, though the storage at their command last year did not enable them entirely to overcome the severe floods during March, October, and December. Even the seventeen days' storage of the East London Company was not sufficient to cope completely with the floods of January and October. For more than half the year, the New River Company's supply was quite free from flood water, and was uniformly of excellent quality. For five months of the year, the quality of the New River supply is said to have been "even better than the average of "the deep-well waters." While it is a fact that, in Nature, even the purest waters contain, almost invariably, minute quantities of organic matter, there is the assurance with regard to the river water as supplied to London, that pathogenic germs are not discoverable in it under the most minute microscopic inspection; and this remark applies even to the water as it presents itself at the intakes, following which there is the further safeguard of the filter-beds before the water passes on to the consumer. Of the deep-well waters, that supplied by the Kent Company contained, on the average, by far the smallest proportion of organic matter. The New River Company excelled with respect to river water—so much so that their supply more than equalled in organic purity the deep-well water of the East London Company, and considerably surpassed that of the Colne Valley Company. Another comparison is furnished by the circumstance that the East London Company's water derived from the Lea was, on the average, somewhat superior to any of the waters derived from the Thames. As a general result, it is shown that the proportion of organic matter in the water supplied from the Thames was lower last year than in any year since 1890. The maximum of such matter in the Lea water was also the smallest observed since that date. The total combined nitrogen, in respect to both the Thames and the Lea, is stated to have been much less than of late years. Yet we used to be told that the pollution of these rivers would inevitably increase with time.

The greater hardness of deep-well waters, compared with the river supplies, is subject to a curious exception. A new well has been opened by the East London Company, which yields water as soft as that usually obtained by the application of Clark's process to chalk water. The effect has been to reduce the hardness of the East London Company's well water, which has dropped from 20·4° to 14°. The water from the Tottenham well last year had 23° of hardness; and that of the Kent wells, very nearly 28°. The Thames water had 20°; and the Lea, 21·5°. The Colne Valley water is softened by Clark's process, so as to bring the hardness down to 7·6°, or about one-fourth its original amount. With respect to the presence of suspended matter, of which much has been said since the appearance of Mr. Dibdin's report on the subject, actual turbidity has practically disappeared from the river supply in London; there being only two samples of filtered water which were in the slightest degree turbid last year. But it happened that 19 samples of deep-well water, which does not usually need filtration, were "slightly turbid," and two were "turbid." The blame of this is laid on the pumping

machinery, which we also find sometimes made responsible for the presence of microbes. Concerning suspended matter in general, Dr. Frankland explains that the purest water in Nature contains abundance of it; and he tells how it is the cause of "the beautiful blue colour of the "purest Swiss lakes and of the Mediterranean." Such minute suspended matter is always present in the most efficiently filtered London waters; but under all ordinary circumstances, it remains absolutely invisible to the naked eye. In order to imbibe a single grain, Dr. Frankland states that it would be necessary to drink no less than 5000 tumblers-full of the water. Such excessively minute quantities of matter, which is presumably harmless, he says may safely be neglected. Indeed, it is pronounced impossible, in any practical way, to obtain water free from it.

Coming finally to the bacterioscopic examination of the supply, the fact is announced that, while there is no water in Nature either chemically pure or free from suspended matter, neither is there any, available for man, which is biologically pure. If by some lucky chance a sample of perfectly sterile water is obtained from a deep well or a filter-bed, it cannot be made to preserve its pristine purity on its way to the consumer. During its passage through the mains, it will become inhabited by crowds of living organisms. But Dr. Frankland is emphatic in combating what he designates the "widespread error," that if the filtered river waters supplied to the Metropolis contain many microbes, such waters are necessarily unwholesome, or at least to be regarded with suspicion. In contravention of this idea, Dr. Frankland is positive that, in the case of the Metropolitan Water Supply, there is no foundation whatever for such a conclusion. He goes on to remark that the standard of 100 microbes per cubic centimetre, adopted by Dr. Koch and himself as an indication of efficient bacterial filtration, is, of course, purely arbitrary, He admits it as a test; but he desires it to be distinctly understood that the infraction of this standard does not throw suspicion upon the wholesomeness of the water. As as instance of the extent to which ordinary river microbes of a harmless nature will undergo rapid multiplication on their way from the filtration works, it is mentioned that, while on Nov. 4 last the filters of the Chelsea Company were delivering into the distributing mains water containing only 12 microbes or germs in a cubic centimetre, the same water drawn from a stand-pipe near the Horse Guards contained 180 microbes per cubic centimetre. In like manner, the Lambeth Company's filters sent out 116 microbes per cubic centimetre, which became 1560 on reaching one of the stand-pipes. The opposite order of things is shown when we come to consider the enormous reduction effected in the number of microbes after the water has passed from the intakes through the impounding reservoirs and the filter-beds. Mere storage has been found to reduce 160,000 microbes per cubic centimetre to less than 1000. Filtration, as now practised, carries the microbean purification to an extraordinary degree of excellence. The percentage of microbes removed, comparing the filtered water with the raw material, amounted on an average during the year to more than 99 per cent. in the case of all the Companies; the highest average being 99·86 per cent., effected by the Chelsea Company. In two cases, the maximum removal amounted to 100 per cent.—a result achieved by the New River Company and the Southwark and Vauxhall Company; the others coming very close to the same point. Without following Dr. Frankland farther, at least for the present, in his admirable report, we may confidently appeal to the document as containing a storehouse of facts more than sufficient to establish the character of the London waters as furnishing a pure and wholesome supply. We may just add a word of our own, by asking: If microbes can multiply at such a rate as they are shown to do in the Metropolitan mains, after being almost reduced to extinction, what may be expected if water is to travel to London from Llangorse?

Gas Traction for Tramways at Ipswich.—As far back as September, 1893, the Ipswich Tramways Company offered to sell their undertaking to the Corporation for £8000; but the offer was refused. Last Thursday it was sold to the Gas Traction Company, Limited, for £12,000, and £5000 in fully-paid shares. The Chairman of the Tramways Company (Mr. W. B. Dicks) visited Blackpool and inspected the system in operation there; and, on the whole, he was very favourably impressed with what he saw.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 954.)

THE Stock Exchange took the outbreak of hostilities last week with wonderful calmness. The markets opened on Tuesday at "war prices," and rather nervous; but before the day was out, it was evident that people were not going to be frightened into selling, and a recovery took place. And so markets continued firm and steady, though very quiet, until towards the close, when the non-arrival of news of a decisive engagement which might put an end to the unhappy strife gave rise to uneasiness; and a weaker tendency set in. On the whole, though prices all round are down, the fall is much slighter than so alarming a factor as war in Eastern Europe might be expected to provoke. The Money Market has been hardly affected at all. Business in the Gas Market was decidedly quiet; but the tendency was good, and in favour of higher prices for all classes of undertaking. In Gaslights, the disposition of "A" to recover, which was just perceptible before the holidays, showed out more clearly. Opening at 302, the price steadily hardened till 304½ was marked at the close; the quotation being advanced a point. There was a very fair amount of business done in the secured issues; and they all commanded good prices, though the quotations were left unchanged. South Metropolitan was only moderately dealt in; and the price still showed no disposition to move. The 5 per cent. debenture stock, being in course of conversion into an equivalent value of 3 per cent. debenture stock, is temporarily out of the list, pending the grant of an official quotation. Nothing at all was done in Commercials. The Suburban and Provincial division was almost as stagnant; but Brentford old changed hands at an advance in price. The preference also rose 5 points. Crystal Palace lost a little off its price; but it could well afford that. Of the Continentals, Imperial moved in an undecided manner—losing one and then regaining two points; but the actual prices at which it changed hands were steady. None of the rest showed any variation, except Buenos Ayres, which had a small advance. The Water Market was unusually animated; business on Thursday being quite brisk. Prices were somewhat irregular; and for the most part not very strong. Chelsea and Lambeth were slight losers.

The daily operations were: Business in Gas was very quiet on reopening after the holidays. Prices, however, were pretty good, notwithstanding that the quotation of Imperial Continental was put down 1. In Water, both Lambeth issues receded 2. On Wednesday, the transactions in Gas were still quiet; prices keeping well up, but without advancing. In Water, Chelsea fell 2. Thursday was a much more active day; and things began to rise. Gaslight "A" advanced 1; and Imperial Continental, 2. The volume of business dropped off again on Friday. Brentford preference rose 2; and Buenos Ayres, ½; but Crystal Palace fell 1⅛. Saturday was quiet; but everything was firm. Brentford old improved 2; and ditto preference, 3.

ELECTRIC LIGHTING MEMORANDA.

Electricity Meter Litigation—Use of Meters for Electricity Supplies—Cost of Private Electric Lighting by Gas-Driven Plant.

ONE of the heavy patent lawsuits of the year, mentioned in this column on the 16th ult., had reference to electric light consumers' meters. It was brought by Mr. George Hookham, of the firm of Chamberlain and Hookham, of Birmingham, against Messrs. Johnson and Phillips, of Charlton and London, as manufacturers of the Perry meter, which was alleged to be an infringement of the well-known meter of the plaintiff's firm. The action was heard by Mr. Justice Wills; superhuman efforts being made by the able Counsel and experts engaged on the respective sides to teach the Court the nature and operation of electricity meters. These efforts were so far successful that the learned Judge has delivered a considered judgment in which he found for the plaintiffs, with the injunction and account prayed for, and delivery up of the infringing articles. A striking peculiarity of the case was the position occupied with respect to the subject-matter by Professor Perry, who, in company with Professor Ayrton, took out in 1882 a patent in which was outlined the theory of the arrangement afterwards worked out by Mr. Hookham. The Court was satisfied, however, that Mr. Hookham was an independent discoverer and inventor, and that Ayrton and Perry did not in their 1882 patent give sufficient practical directions by which a skilled workman could have made an electricity meter that would act. Professor Perry admittedly took up the thread again in 1890; and the infringing meter is made under a patent applied for by him at this date. Hence the curious result is produced of a man being pronounced an infringer of somebody else's patent which depends upon a theory laid down in the first place by himself. Upon this the Judge remarked that the law is that, "In order to give right to a monopoly, the patentee must not merely set a problem, and perhaps even render it not very difficult to solve, but must

condescend to practical details; so that at the expiration of the patent the rest of the world may be able, without further experiment, to make the patented article." This condition the Judge considered that Professors Ayrton and Perry did not fulfil in 1882; wherefore "they cannot complain that another should travel by the road they have discovered up to the door they did not unlock, and, having found the key himself, should unlock the door, go in, and shut them out." This is a luminous way of putting the point, all the more impressive from the learned Judge's known aversion to the employment of metaphor where-ever plain terms will serve.

In view of the importance of the commercial issue, it is pos sible that the case may be appealed. Meanwhile it is permissible to congratulate Mr. Hookham upon the legal triumph he has obtained for his valuable invention, which unquestionably was the first practically working electricity meter on something like all-fours with the dry gas-meter. For although Professor Hopkinson ventured to tell the Committee on the Electric Lighting Bill of 1882 that electricity meters suitable for consumers' use were in existence, the only appliances of the class then extant were complicated clockwork and electrolytic affairs that could never have had more than a very partial application in every-day use. There was the Ayrton and Perry clock-meter, or "ergmeter" as it was called, the Edison galvanic cell device, and Professor Forbes's resistance coil and vane arrangement. None of these, however, was competent to alter the practice of charging for electricity supplies for interior lighting by time; and, speaking broadly, it was only after the appearance upon the market of the Chamberlain and Hookham meter that such supplies came to be measured as an ordinary thing. This change in the basis of the electric lighting business, while not quite so momentous as was the earlier introduction of the gas-meter in the case of the gas industry, was nevertheless a very important epoch in the development of the industry; and it would seem an injustice to deprive those who were most instrumental in bringing about the change, of whatever credit and reward may proceed from the fact.

Some interesting particulars as to the cost of running small isolated electric lighting plants were recently given by Mr. Percy Rosling in a letter to the Editor of the "Electrical Review." The writer laid down the rule that in installations of this character it is not at all out of the way, if the work is properly gone about, to get a duty of fifteen 16-candle power lamps per brake horse power. He mentioned two examples—one a private house installation of twenty-four 16-candle lamps run at 40 volts; the other of sixty-five 16-candle lamps run at 60 volts—both of which were found to compare favourably with the previous cost of gas lighting. The smaller plant consists of a ½-horse power gas-engine, a 900-watt dynamo, and 22 K 7 cells; the larger, of a 4-horse nominal gas-engine, 3600-watt dynamo, and two sets of 33 K 11 cells used in parallel. In both cases, high-efficiency lamps—2½ watts per candle power—are in use; this being equivalent to 16 lamps per brake horse power when the dynamo efficiency is 85 per cent. The life of the lamps is short; but this is hardly noticed in house lighting. In the first case, the renewals over a period of three years average six lamps a year; in the second, it has run to ten new lamps yearly over four years' service. The gas bill for the ½-horse engine averages £6 10s. per annum, and that for the 4-horse engine £9 10s.; gas in both cases being 2s. 9d. per 1000 cubic feet. The gas lighting bills were £7 and £19 a year respectively. In neither case is direct running ever resorted to; the cells being kept charged between one-quarter and three-quarters full. The larger of the two plants is in the charge of a gardener; the smaller, of one of the maid-servants. Sixpence would pay for all the acid used in the two houses in three years; and the oil costs about 12s. a year in both cases. As regards running direct on a 250-light installation, with 60-watt lamps, Mr. Rosling claims to have got in the regular way a duty of one 16-candle lamp per 1·7 cubic feet of gas burnt in the engine, of 16-horse power nominal—as verified over and over again. After about two years' running (five hours nightly), the gas consumption was found to have increased to 2 cubic feet per lamp. The engine was then overhauled, and new piston-rings fitted, and the gas consumption again dropped to 1·7 cubic feet per lamp per hour,. From these examples, Mr. Rosling concludes that "the over-all cost of running is, for a small plant, on a par with gas; and on anything larger than the smallest, considerably less. The interest and depreciation on the plant is usually more than covered by the saving on furniture, fittings, and paper; the ratio, of course, depending on the style of house-fittings, pictures, books, &c." Assuming the figures to be reliable, this appears to be a perfectly fair conclusion. At any rate, it is not unreasonable to suppose that householders who would be disposed to go in for private electric lighting on this scale and in this manner would be well satisfied with the working results indicated. One would like to know exactly what the installations cost, and what the total working expenses are. Gas bills for lighting practically cover everything and all trouble; whereas even in the working of a ½-horse power engine, looked after by "one of the maids," there must be involved a number of small considerations that mean both expense and carefulness. Anyway, however, this statement of Mr. Rosling is one of the most interesting of its kind we have seen for a long time in the pages of our electrical contemporaries; and it is deserving of earnest attention by gas engineers.

AN ENTRANCE EXAMINATION FOR THE INSTITUTION OF CIVIL ENGINEERS.

WHAT is an engineer? The question is easier asked than answered; but it is suggested by the recent announcement of the intention of the Institution of Civil Engineers to adopt an examinational test for candidates for the grade of Associate Members. This is a matter that concerns a large number of regular readers of the "JOURNAL," and is therefore proper to be discussed here. The Institution of Civil Engineers has hitherto occupied an essentially English, which is as much as to say an utterly illogical and accidental, position with regard to the national profession of civil engineering. Founded by men who were engineers first and members of a mutual association afterwards, the Institution was for a long time a somewhat exclusive body. The nature of civil engineering was defined very broadly by Telford, in the familiar sentence that stands at the commencement of the rules of the Institution. But, as a matter of fact, Telford's contemporaries and their successors entertained strict and rather narrow notions as to who was qualified for membership of the Institution. They did not admit, for example, that mechanical engineers came within the pale; and partly as a result of this exclusiveness, the Institution of Mechanical Engineers was created, to become the first of a considerable number of specialized organizations. To the late Secretary of the Institution of Civil Engineers, Mr. James Forrest, is usually ascribed the credit for throwing open the Institution to engineers of every denomination. At any rate, for many years a vigorous propaganda was carried on under the patronage of the Council, with the avowed object of bringing into the Institution as many practising engineers as could be prevailed upon to support the new idea of making it the chief professional organization. This movement was successful. Engineers were persuaded, and persuaded each other, that membership of the senior professional society was desirable; and the result was eminently beneficial to the Institution itself, whatever was the case of the majority of the subscribing members.

With all this, of course, the Institution continued to be no other than a purely mutual society, membership of which could mean nothing more than a stamp of eligibility under the rules thereto applying. It is unnecessary to elaborate this point; but it is obvious that the very constitution of the Institution differentiated it from the Continental official organizations, Universities, and so forth, that grant "degrees" in engineering science. The certificates of membership of the Institution were no diplomas, creating a qualification to practise the profession, but were, and are, neither more nor less than acknowledgments of the fact that those who have received them were already practitioners. It is precisely the same with the American Society of Civil Engineers. Neither organization has hitherto professed to fix a qualification for the profession which supports it. This is what the Continental and some of the newer American Universities and Government educational departments do; and the difference goes right down to the roots of the profession. There are State manufactured engineers in England too. The Navy, and the Army, and the Indian Civil Service, have engineering seminaries which grant what are equivalent to degrees. Hitherto, however, this aspect of engineering tuition has been regarded as altogether distinct from the ordinary, free, and open practice of the profession, whether in England or America. Service and scholastic engineering must necessarily conform to defined standards of knowledge which relate to the subject matter. The State has, in England as well as in India, numerous affairs and responsibilities which a regularly trained and selected corps of public servants must deal with. On the Continent, where railways, roads, bridges, water supply, town sanitation, and similar matters are under the care of the central government, the need for academically trained engineers is far greater. In the United Kingdom, however, and in America, the open engineering profession has been an outcome of the employment of the free energies of an ingenious and industrious people in doing the things that wanted doing, when necessity arose.

What, then, is an engineer? Dr. Kennedy defined him on one occasion as "a man who is always being called upon to make up his mind." An American definition is "a man who can do well for one dollar what any fool can do badly for two." These definitions leave out a good deal; but they agree in putting the doing of something, as distinct from knowledge, as the main characteristic of engineering. Engineering, then, is concerned with executive ability, rather than with ability to acquire information. At the same time, knowledge of the best way to do things should precede the attempt to do them; and failure in this respect has always been a weakness of English engineering. It must naturally be so with experimental operations; and all engineering is experimental to begin with. Probably the right view of the question, and the view that the Council of the Institution have taken, is that civil engineering has now arrived at a stage of development when those who essay to practise it can find ready to hand a body of verified doctrine which it is highly desirable that they should be familiar with before they go further. This being so, there is no reason for objecting to the proposal that some test of the possession of a reasonable degree of mastery of this technic should be imposed on those who seek admission to the chief technical society.

The wonder is that the Institution of Civil Engineers has not

taken this step before. If the new rule is properly administered, the grade of membership of the Institution to which it applies will possess in time a definite value to the younger members of the profession which has hitherto been lacking. Civil engineering can never be—at any rate in England or in America—one of the close professions, to which admission will only be obtainable by the way of examination. From the moment, however, that this test is applied, it will begin to operate ever wider and deeper through the whole range of the preliminary studies and training of would-be engineers. When one first hears of such a gateway being set up across what has been an open thoroughfare, one is naturally led to think of the great names of history whose owners would probably have failed to pass it. As our contemporary the "Electrician" observes in the same connection: "It is certain George Stephenson would have failed in an examination. Possibly Watt might have managed a thesis; whilst Murdoch, the inventor of gas-lighting, would undoubtedly have been refused had he in his time dared to propose in a paper his (as was then thought) preposterous scheme of lighting the streets by gas." This is quite true; but, as none knows better than our contemporary, it is a cheap and altogether unhelpful way of looking at a proposal intended to prepare for the future. This is the sort of thing that would-be popular writers on technical subjects for the newspapers fall into, when they ask what our slow-going old ancestors would think if they could come back and take a ticket for the East Coast express. All the world knows what manner of man George Stephenson was, and Watt, and Murdoch, and what they did for us. But George Stephenson would be sorely put to it if called back to take charge of the locomotive department of the London and North-Western Railway; Watt would not know how to engine a torpedo-boat catcher; and Murdoch would beg to be excused from having to do with the London Gas Referees. Every man for his epoch.

Inasmuch, therefore, as the new proposal of the Institution of Civil Engineers is calculated to improve and solidify the groundwork of professional efficiency, it is to be approved. The Institution are only doing what even the Accountants have found it expedient to do. The experience of all these professional organizations is very much the same. First they gather together the representatives of the calling or occupation whom it is desired to organize for mutual advantage and the common good; and then the attempt is made to assert, on the part of the organization, some authority over the conduct of the art to which its supporters belong. Within proper bounds, this is a perfectly legitimate, even a noble development of the original movement. For none knows better than the old professional man the shortcomings of individual equipments against which he has had to struggle; and when he has arrived at the summit of his career, he is both able and, as a rule, willing to tell the the neophyte how to be provided against the stress that must come upon him in his turn. George Stephenson has been cited as an example of a man who would have failed in an examination; but how hard he laboured to gain the scanty schooling that he made go so far, and how careful he was to give his son the best education that was to be had! No engineer who ever truly deserved the name was ever heard to complain of having too much information; while most have had reason to bitterly regret the insufficiency of their mental equipment.

There is no reason to fear that an educational test at the beginning of his career will act as a deterrent to the true engineer, and so prevent him from realizing the utmost of which his native powers and his external opportunities may be capable. It has not been so in medicine, in law, or in the national services. We know, of course, that Nelson could not have passed a navigating lieutenant's examination as now set, and suspect that Wellington and Buonaparte might both have been "ploughed" easily by a present-day Staff College paper. If these great men lived now, however, they would agree that the best of all possible training and tests cannot be too good for the future guardians of the nations; and the professions must be equally well safeguarded. All our technical contemporaries that have discussed the subject, express general approval of the new Institution rule; and we also approve, subject to the consideration that any examination paper in engineering must be couched, so far as may be possible, to test the competence of the candidate rather than set the standard of what constitutes engineering knowledge. The distinction may not be easy to define, but it is a very real one, and should not be lost sight of. It might be put in this way—that an engineer might be required to know certain things, while knowledge of the same things need not be interpreted to signify that the man who has it is an engineer.

Those who will settle the new standard of membership of the Institution are not to be envied their task. The "Electrician" wisely observes that "the experiment (for such it is) will be watched with interest by other engineering Institutions, though it will necessarily be some time before its effect will be observable; and, if successful, the principle of examination will doubtless be adopted by most of them." We agree with all but the last part of this observation. If the pass examination of the Institution is properly managed, it ought to be enough for all the purposes of the profession. There would be no advantage in a multiplicity of engineering certificates; and, so far as gas engineering is concerned, there is no need whatever for supplementing what the Institution of Civil Engineers proposes to do in this regard.

PERSONAL.

Mr. A. E. HALL, Solicitor, of Eckington, has been appointed Secretary of the Eckington and Mosbro' Gas Company.

Mr. J. E. HUGHES, the Superintendent of the Butterley and Blakeley reservoirs of the Huddersfield Corporation, has had his salary increased from £400 to £600 a year.

Mr. F. J. WARD, of Wigan, has obtained the appointment of Secretary and Manager of the Knowle and District Gas Company, Limited, which was advertised in the "JOURNAL" for the 13th inst.

Mr. R. J. LUKEY, the Secretary of the Australian Gaslight Company, Sydney, has been appointed a Magistrate for the colony of New South Wales. Before leaving England for the Colonies, Mr. Lukey was at Falmouth.

Mr. PETER WATSON, the venerable Manager of the Stirling Gas Company, has resigned his position as from Whitsunday next. As negotiations are far advanced for the transfer of the gas undertaking to the Corporation of Stirling, the Company have requested the Corporation to confer with them as to the management of the works after Mr. Watson leaves.

The work done by Mr. W. F. COTTON, J.P., the Secretary and Manager of the Alliance and Dublin Consumers' Gas Company, in bringing the undertaking into its present prosperous condition, receives appreciative recognition in the current number of "£ s. d.," the Irish financial review, which contains a well-executed portrait of Mr. Cotton, reproduced from a photograph. The fiftieth anniversary of the Company's incorporation will be reached on the 21st of June; and the present Secretary has witnessed nearly half the number, having received his appointment on Oct. 1, 1873.

Mr. F. J. WINTER has been appointed Junior Assistant to Mr. C. E. Botley, M.Inst.C.E., at the Hastings Gas-Works. Mr. Winter is the son of Mr. A. Winter, lately Manager of the Sevenoaks Gas Company, and grandson of the late Mr. R. Winter, of the St. Mary Cray Gas-Works. He was articled to Mr. J. Tysoe, at the East Greenwich works of the South Metropolitan Gas Company. On Thursday, the 15th inst., the officers and foremen of the works met in the Engineer's office and presented to Mr. Winter (who has just taken up his duties at Hastings) a case of drawing instruments with a suitable inscription. Mr. Tysoe made the presentation.

The pleasure derived by Mr. ALFRED T. LAYTON, J.P., one of the Directors of the Crystal Palace District Gas Company, from the social gatherings which are so conspicuous a feature of the municipal life of Croydon, has just been generously recognized by him in a noteworthy and specially appropriate manner. He has forwarded a cheque for £2000 to the Croydon County Council, of which he is an Alderman, to be invested, and the interest applied in part to the encouragement of "social intercourse," and in part to the benefiting of the staff and employees of the Council, by affording them facilities for obtaining medical and surgical assistance in case of ill-health or accident.

The officials and workmen of the Hastings and St. Leonards Gas Company had a very pleasant gathering on Monday, the 12th inst.; the occasion being a smoking concert at which they bade farewell to Mr. R. BROWN, who, as already announced in the "JOURNAL," has obtained the position of Manager of the Cambridge Gas-Works in succession to Mr. O. J. Weeks. Mr. C. E. Botley, M.Inst.C.E., the Engineer and Manager, presided; and, in the name of the employees, he presented Mr. Brown with a gold watch, subscribed for by them, as a token of their esteem, and expressed their best wishes for his future prosperity. Mr. Brown, in acknowledging the gift, said it had been a pleasure to him to be associated with Mr. Botley; and in his new sphere he should always endeavour to cultivate the good feeling between officials and workmen which prevailed at Hastings.

In recognition of the great services rendered to the Jersey Gas Company by Mr. J. MORRIS, who for the past thirty-four years has held the position of Engineer and Manager, the shareholders recently presented him with a beautiful silver epergne. It is 3 feet high, measures 2 feet across the base, and weighs 340 oz. It stands upon a plateau, and in the form of a vine with five branches, each supporting a cut-glass dish, and having a silver basket hanging from it. At the foot of the vine are three figures representing "Friendship." Upon the base of the epergne and on the plateau is an inscription setting forth that the presentation was made in virtue of a resolution unanimously passed at the annual general meeting of the Company on Oct. 13, 1896, recording the shareholders' sense of the "unremitting assiduity, zeal, and devotion" displayed by Mr. Morris; and also as a "substantial expression of their unbounded confidence and esteem."

Society of Engineers.—At the meeting of the Society next Monday, Mr. Henry O'Connor (one of the Vice-Presidents) will read a paper on "Automatic Gas Station Governors." The author will enforce the necessity for having a station governor in gas-works, and give rules for finding the counter-balance weights required for different pressures. The various kinds of governors will be described; and the author will explain how the output of gas may be registered by pressure.

NOTES.

The Strength of Riveted Joints.

The strength of riveted joints is usually computed from data which are accepted on the authority of text-books. Recently a series of experimental tests of riveted steel plate joints was carried out at the Watertown Arsenal for Messrs. E. Kendall and Sons, the results of which are reported in the "Engineering Record." The tests were all made with half-inch steel plates and $\frac{7}{8}$-inch rivets; the holes being drilled to $\frac{15}{16}$ inch. The ordinary double-riveted lap joint, $13\frac{1}{2}$ inches wide, with rivets pitched $3\frac{3}{8}$ inches apart, broke at a strain of 47 per cent. of the tensile strength of the plate. A butt-joint with double covering-plates, one $10\frac{3}{8}$ inches and the other $5\frac{1}{4}$ inches wide, with four rows of rivets, broke at 57 per cent. of the strength of the plate. A similar butt joint with the lower covering-plate $15\frac{1}{2}$ inches wide, with four rows of rivets, the two rows of through rivets being pitched $2\frac{1}{2}$ inches apart, gave an efficiency of 78 per cent. In another series of tests, made with the ordinary form of triple-riveted butt-joints, having one covering-plate 10 inches and the other $15\frac{1}{2}$ inches wide, the joint gave way under a strain of 80 per cent. of the strength of the solid plate. This was with rivets pitched $3\frac{3}{8}$ inches apart. Pitching the rivets at $2\frac{1}{2}$ inches increased the strength of the joint to 83 per cent. The net result of the trials was to show that the closer pitching of the rivets secures the stronger joint; and that, in any case, a triple-riveted butt-joint, with double covering-plates, can be made to show an efficiency of from 80 to 85 per cent. of the strength of the solid plate under the conditions stated.

Heat-Indicating Paints.

At a recent meeting of the Physical Society, Dr. Thompson exhibited specimens of a heat-indicating paint composed of a double iodide of copper and mercury, originally discovered twenty years ago by a German physicist. At ordinary temperatures, the paint is red, but when heated to 97° C. it turns black. Paper painted with this composition, and warmed at a stove, exhibits the change in a few seconds. A yellow double iodide of silver and mercury is even more sensitive to heat; changing from yellow to dark red at a temperature of 45° C. Paint of this character has been recommended for use upon machine bearings, in order that by change of colour it might give warning of the approach of undue heating. It has also been suggested that the casings of coal stores and other structures intended to be used for housing materials subject to spontaneous combustion might be painted with a composition of this kind; but the suggestion, so far as we know, has never been carried into effect. Perhaps this is due to the costliness of the paint itself. A double iodide of copper and mercury, to say nothing of the iodide of silver and mercury, does not sound like a cheap compound such as would be commonly used in machine shops.

Problems of Luminescence.

Mr. M. A. Edson has recently been discoursing to the Chicago Electrical Association upon lighting by incandescence, with more special reference to the luminous effects producible in vacuum tubes by electrical excitation. Mr. Edson discussed the comparative light-efficiencies of the best-known kinds of artificial lights; and he concluded that, though in one sense the light of the glow-worm is the most efficient, having regard to the corresponding amount of heat generated, the light of the future will not be of this character. His ideal is to approach more closely to bright sunshine as the source, and then to diffuse the light as perfectly as possible. He has been experimenting upon the reflective capacity of samples of wall-paper when exposed to natural daylight and different kinds of artificial lights; and he has decided, from the indications thus obtained, that the lighting quality of incandescent carbon leaves much to be desired. It is not sufficiently under control, and can only be varied in tint by the employment of coloured shades. Mr. Edson refers to the vacuum tube lighting exhibited by Tesla and others, only to observe that it has no practical value. Mr. Edson himself has nothing better to offer; but he ventures to hint that something may be done with self-luminous gases confined in tubes at ordinary pressures. His chief fancy, however, is for wall-paper lighting, to coin a phrase for what is at present only the most shadowy of suggestions. The idea is that of a substance which, when subjected to high-frequency low-potential electricity, will give light. The substance must also be capable of being mechanically or chemically mingled with the pigments used in the manufacture of wall-paper or the colouring of ceilings. It is, moreover, to be of such a nature that when mixed with pigments it will not show by daylight, but exhibit the colour in its true value when electrically excited. Mr. Edson would prefer the amount of light emitted in this way to be about one candle power per square foot of wall surface. He admits that "the details of such a system are at present obscure." It would be more candid to state that they do not exist.

Cleaning Ironwork by Sand-Blast.

An extensive experiment in cleaning and painting structural ironwork is in progress in New York City, under the supervision of Mr. E. P. North. It is with regard to the maintenance of a large viaduct that spans a railway; and a selected number of paint manufacturers have been instructed to clean and paint parallel areas of the structure, which will be allowed to stand for a year. The most satisfactory specimens will qualify the contractors to tender for the future maintenance and painting of the whole structure. The first condition to be fulfilled is that every competitor shall clean his portion of the ironwork from rust, scale, and old paint, without the use of water or acid. One firm have commenced operations by trying the sand-blast for this part of the work. A portable apparatus was rigged up, consisting of a movable steam-engine, an air-compressor, and a sand mixer and blower. With air at a pressure of from 18 to 20 lbs. per square inch, blowing sharp sand through a $\frac{3}{4}$-inch nozzle, iron columns were cleaned at the rate of about 2 square feet per minute, with a consumption of about one-tenth of a cubic foot of sand per square foot of cleaned surface. A similar test undertaken at the Brooklyn Navy Yard resulted in the cleaning of 25 square feet of a vessel's bottom plates in about six minutes; and the work was far superior to hand scraping, inasmuch as every crack and crevice was penetrated and revealed.

An Automatic Coal-Hoist and Weighing Machine.

A description has appeared in "Engineering" of a coal weighing and recording machine that has been designed by Mr. Charles Ingrey for Messrs. W. Cory and Son, for use at their Victoria Docks derricks. At this station the coal is discharged from steam-vessels moored on one side of the timber staging that carries the unloading plant, and delivered at the other side of the stage into barges. The work is done by hydraulic cranes and 1-ton skips. At every hoist, a pause is made, under the old system, for weighing the contents of the skip, which must be recorded by a "meter man." The delay caused by the resting of the load, the necessity for employing a meter man at every crane, and the liability to error in the results, are serious objections to this system, which Mr. Ingrey has overcome. In the new arrangement, the weighing and recording are effected automatically, and without stopping the cranes. A hopper is provided, into which the skip is emptied; and the weighing and recording are done while the empty skip is being swung back to the hold. The hopper receives the coal practically as a rigid container; but as the crane swings away it releases an ingenious set of levers, whereby the hopper becomes the pan of an automatic weighing-machine. The coal weighs itself; the weight being recorded upon an index in tons and decimal parts of a ton. In connection with this machine, Mr. Ingrey has also devised what he calls a barge-loading apparatus, for delivering a regulated quantity of coal into a barge. When the proper load has been delivered, a bell is set ringing to warn the attendant of the fact.

Iron and Steel Institute.—The annual meeting of the Institute is to be held at the Institution of Civil Engineers on the 11th and 12th prox., under the presidency of Mr. E. P. Martin; and a varied and interesting programme of subjects for discussion has been prepared. There are twelve papers, one of which will be of special interest to our readers, as the author—Mr. F. J. R. Carulla, the Chairman of the Nottingham Section of the Society of Chemical Industry—will discuss the subject of the agricultural value of sulphate of ammonia from blast-furnaces. On the evening preceding the meeting, the retiring President (Sir D. Dale) and Lady Dale will hold a reception at the Royal Institute of Painters in Water Colours. On assembling the following morning, one of the first items of business will be the presentation of the Bessemer Gold Medal for 1897 to Sir Frederick Abel, K.C.B.

The Softening-Point of Coal-Tar Pitch.—At a recent meeting of the Manchester Section of the Society of Chemical Industry, Mr. W. F. Keating Stock described, in the course of some laboratory notes, an apparatus for ascertaining the softening-point of coal-tar pitch. It consists of a cylindrical copper vessel, 13 centimetres high and 12 centimetres wide. It is fitted with three little copper brackets fixed inside the vessel near the top, and three similar ones rather lower. The brackets are arranged at equidistant points around the circumference of the vessel; the lower three being fixed so as to lie in the intervals between the upper three. Their object is to carry a circular perforated zinc platform, fitting easily into the copper vessel. This has three semicircular gaps cut out of its circumference, corresponding in position to the brackets. The platform has an aperture in the centre 1 centimetre in diameter, round which is soldered a perforated zinc tube. At opposite sides of the tube are soldered two stoutish brass wires, which carry a little copper disc having a hole bored through it centrally. This fitting acts as a support for the necessary thermometer, which is fixed in the perforated tube by means of an ordinary cork. The use of the apparatus is to obviate the necessity for strings or wires to support the test pieces of pitch. The copper vessel is filled with water at the required temperature, and set on an iron plate over a suitable burner. The zinc platform is lowered on to the bottom set of brackets, and left there till the temperature is steady. It is then raised, and a half revolution allows it to rest on the upper brackets. The test pieces are laid upon it, four at a time. It is reversed a half turn, and lowered again. It now rests on the under brackets; and the test commences. At the end of the time agreed upon by the contract note, the platform is raised, a half turn is given, and it rests upon the upper brackets. The test pieces are then twisted one after the other without loss of time.

COMMUNICATED ARTICLE.

THE USE OF LIME FOR GAS PURIFICATION.

By S. CARPENTER, of East Ham, Essex.

It is very important, where lime is used for the purification of coal gas from carbonic acid and bisulphide of carbon, to have the best that can possibly be procured. At the present time, the best kind for this purpose is flare lime, burnt from good chalk. For fuller details on the quality of lime, I must refer the reader to my pamphlet on "The Purification of Coal Gas." It appears that hydrate of lime, used in a dry lime purifier, is now the most effectual, economical, and the least hurtful agent to which impure gas can be subject. No practical man can venture to deny this. In years gone by, and even in our own days, those best acquainted with the manipulation of lime, and with the purification of gas in a practical way, would acknowledge that lime is the only substance which will effectually remove from coal gas its chief impurities—carbonic acid, bisulphide of carbon, and sulphuretted hydrogen—without so seriously affecting the illuminating power as to require the introduction of a new element in the calculation of the cost; that is to say, the employment of cannel coal to compensate for the injury which other purifying agents than lime cause to the light-giving power of gas.

When lime is exposed to crude gas, it has a great affinity for two of the above-named impurities; whereas oxide of iron has only the power to remove the sulphuretted hydrogen. Pure lime absorbs carbonic acid, and sulphuretted hydrogen, but not bisulphide of carbon. But when it has been exposed to the crude gas for some time, it is converted into "hydrogenated" sulphide of calcium—a substance which has a powerful affinity for, and absorbs the carbon bisulphide. Carbonic acid exists in the gas in very much greater proportion than sulphuretted hydrogen—being something like three volumes to one. When the crude gas is passed into the first lime purifier, the lime exercises its greater affinity for the carbonic acid, and so a large portion of the sulphuretted hydrogen in the gas passes on to the second purifier, the lime in which is soon converted into hydrogenated sulphide of calcium, which, as already mentioned, possesses the power in a high degree of absorbing that stubborn impurity bisulphide of carbon.

As lime alone is the only substance which will effectually remove the three chief impurities from coal gas, it is very important that it should be employed for the removal of the carbonic acid, for two reasons—first, because the acid interferes with the removal of the bisulphide of carbon; and, secondly, because it destroys the illuminating power to the extent of 7-10ths of a candle. Moreover, bisulphide of carbon should be taken out of the gas as much as possible; and lime is at present the best known agent for doing this. If the ammonia is removed from the gas, and the lime employed in a practical way as well as air and oxide of iron, the gas will be in a condition that may be called pure.

It is absolutely necessary to frequently take the temperature of the gas as it passes from one appliance to another, as there may be at times furnace gases passing through broken retorts into the hydraulic main, which would raise the temperature, and materially interfere with the process of purification. The writer found the work of purification going on satisfactorily, and the sulphur reduced to 10 or 12 grains in 100 cubic feet, when the following temperatures were recorded:—

	Summer.		Winter.
Air	68° Fahr.	..	40° Fahr.
Outlet of hydraulic main	132 ,,	..	115 ,,
,, condensers	86 ,,	..	50 ,,
,, scrubbers	68 ,,	..	47 ,,
,, first lime purifier	88 ,,	..	58 ,,
,, second ,,	85 ,,	..	64 ,,
,, first oxide purifier	76 ,,	..	52 ,,
,, last ,,	70 ,,	..	42 ,,

It has been said that lime should not be slaked until just before it is put into the purifier, as the atmospheric air would convert it into carbonate of lime, which has no affinity for sulphur in other forms than sulphuretted hydrogen. As there is only 0·04 of carbonic acid in 100 measures of atmospheric air, how many years would it require to convert into carbonate of lime sufficient slaked lime—say, 20 yards—to charge a purifier? No one could possibly tell. In practical experience, the writer has found the following to be the best way to prepare lime for the purification of coal gas: First spread the lime over a space about 8 feet square in a layer 1 foot thick. The quantity of water to be used in slaking is about 4 or 5 gallons to a bushel of chalk lime. Spread another layer about 1 foot thick on top of the first; and water this in the same way. Continue the operation by adding three more layers, and let the whole rest for one or two days. Then it must be turned over and thoroughly mixed, and afterwards heaped and allowed to remain for three or four days, when it will be in a fit condition to be put into the purifier. If the lime is not well slaked, and all of the same dampness, it will be liable to what are called "blow-holes," which would allow the gas to pass through, and be attended with serious consequences.

As much has been said on the use of hydrate of lime for the purification of coal gas, it will not be out of place to notice other ways in which it has been employed for this purpose. Instead of the crude gas going into the lime purifier, it has been sent first into the oxide of iron box, so as to purify it from a part of its sulphuretted hydrogen before being subject to the action of the lime. But as the oxide can only take out the sulphuretted hydrogen, this practice, instead of doing good, only does harm, as it interferes with the chemical action taking place between the crude gas and the lime. The following are the results, in grains of sulphur per 100 cubic feet, of some testings made of gas which had been partly purified by oxide of iron, when passed through lime to remove the bisulphide of carbon, and afterwards through oxide of iron to take out the remaining sulphuretted hydrogen: 29·88, 25·77, 32·81, 29·40. There was no carbonic acid in the gas tested.

The writer has had practical experience for many years in working purifiers charged with cream of lime for the purification of coal gas from sulphuretted hydrogen and carbonic acid. This material, however, did not remove all the carbonic acid; there were still found slight traces in the gas when it was tested for this impurity. The following are the results, in grains of sulphur per 100 cubic feet, of some of the testings: 31·18, 29·48, 33·96. These testings were made with gas that had been purified with lime and oxide of iron. The crude gas was first passed into the purifier charged with lime, and then into the one containing oxide of iron, to eliminate the remaining sulphuretted hydrogen. Testings for bisulphide of carbon gave the following results: 13·20, 14·40, 15·00.

Lime has been employed for the purification of coal gas ever since the manufacture of gas was commenced. The difficulty now experienced in using it existed many years ago. The time came when many complaints were made by sanitary officers of the nuisance arising from the spent lime. But there need not be any trouble now, if the purifiers are ventilated in the manner I have recommended in the pamphlet already mentioned. Lime was abandoned in many works because of the nuisance it caused, and oxide of iron was substituted. This was about the year 1850. After the oxide had been used for several years, complaints were made as to the illuminating power of the gas, and the quantity of sulphur in other forms than sulphuretted hydrogen contained in it; and the result was that lime had to be re-introduced.

In the manufacture of gas, the effect of distillation of the coal is to produce a vapour which in its first condition is charged with various impurities. Some of these are removed by the processes of condensation, washing, and scrubbing; and the remainder can be taken out by lime, oxide of iron, and atmospheric air. As the vapour, or coal gas, issues from the retorts, it contains the following impurities: (1) Tar, which consists of various ingredients; (2) watery vapour; (3) ammonia; (4) carbonic acid; (5) sulphuretted hydrogen; (6) bisulphide of carbon. After condensation, the gas is first well washed with ammoniacal liquor and clean water, to remove the ammonia; it is next passed through lime, to extract carbonic acid and part of the bisulphide of carbon; and then it goes through oxide of iron, to eliminate the remaining sulphuretted hydrogen. This being the process of manufacturing coal gas, the writer ventures to think he has pointed out the proper method of using the different agents which he has described, so as to produce uniformly beneficial results in ridding it of all its impurities. To ensure the purity of gas, it should be tested at intervals at the various oxide of iron purifiers. In this way, knowledge is acquired as to when it will be necessary to change the purifier. The operation of testing should be carried out in this way: Pass the gas from the top of the purifier, at the rate of a foot per hour, through a piece of glass tube, about 12 inches long and 1 inch in diameter, inside of which is a small piece of bibulous paper saturated with a solution of acetate of lead. By testing the gas in this way, the presence of sulphuretted hydrogen is shown. The paper should be damped when put into the glass tube, and allowed to remain there undisturbed for about three hours if the gas is clean. The gas should be tested three times a day.

In conclusion, I may say that I am writing these articles solely for young gas managers; and if they have been of use to anyone, I shall be glad to receive acknowledgment thereof through the columns of the "JOURNAL." This will encourage me to write more.

The Public Lighting of American Cities.—According to "Progressive Age," the cost of street lighting in New York City for the year 1897 will be in excess of $1,250,000. The specific appropriation for this item is $1,222,821, to which amount are to be added sundries, which will probably bring it up to the total named. Philadelphia spends even more than does New York in a year for lighting its streets and alley-ways; the total expense being $420,000 for gas and $647,000 this year for electricity. Chicago expends in a year $425,000 for gas-lamps, which illumine with indistinctness some of her streets, the major portions of which are unpaved roads separated from the buildings which front them by wooden side-walks resting in the mud. Boston spends in a year $290,000 for gas and $270,000 for electric lighting—a total of $560,000; Baltimore, $220,000 for gas and $140,000 for electricity; Cincinnati, $200,000 for gas and $75,000 for electric current.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Seventeenth Half-Yearly Meeting of this Association was held last Wednesday at Peterborough, which, as decided at the previous meeting, is to be the spring centre for the future. It was a happy thought that suggested that Peterborough should be the home, as it were, of the Association; for, in addition to its accessibility to most of the members, it was there that the Association was brought into existence on Sept. 26, 1888. On that occasion, at the ordinary meeting about two years later, and again last Wednesday, the Directors of the Gas Company and their Engineer (Mr. John Barton) gave ample testimony of the lively interest which they take in the welfare of the organization; and it must be encouraging and pleasing to the Committee to find that this interest is not likely to abate.

The members assembled at the Grand Hotel, shortly after noon on Wednesday for luncheon. Afterwards they repaired to the gas-works; and the business meeting was held in the Board-room.

Words of Welcome.

At the commencement of the proceedings,

Mr. A. Drage (East Dereham), the retiring President, occupied the chair, and introduced to the members Mr. W. Harris, the Chairman of the Gas Company, and Mr. Alderman Redhead, one of the Directors.

Mr. Harris said he wished, on behalf of the Directors, to give the members a very cordial welcome, and to say that anything they could do to make the annual visits of the Association agreeable and useful, they would be most happy to do. Personally he had taken a great interest in the meetings of gas managers for the last 25 years. He had carefully followed the papers and discussions as reported in the "Journal of Gas Lighting;" and he had learnt a great deal from them. If they would excuse him doing so, he should like to suggest that there was one subject which they might with advantage occasionally introduce for discussion, and that was the financial aspect of gas companies in relation to the auction clauses and the sliding scale; for he was inclined to think this was one of the weak points of gas companies. Not that the auction clauses and sliding scale were not good things; they were good for the consumers and for gas companies too he thought. The only question that occurred to him was whether the financial aspect of these clauses had been sufficiently considered—whether the greater profit that could be obtained by gas companies in this way was appropriated in the best possible manner. If gas managers would turn their attention to the subject, and give the directors of the companies their views on it, it would no doubt be beneficial to them. Gas companies somewhat resembled fortifications in this, that they were no stronger than their weakest point; and the thing was to find out the weakest point and make it as strong as they possibly could.

Mr. Drage thanked Mr. Harris for the heartiness of his welcome, and expressed the hope that a paper would be introduced for discussion at one of their meetings on the subject referred to.

Confirmation of Minutes.

The Hon. Secretary (Mr. J. H. Troughton, of Newmarket) read the minutes of the meeting held at Retford on Sept. 16; and they were confirmed.

New Members.

The following gentlemen were elected members of the Association: Mr. R. Brown, of Cambridge; Mr. W. R. Chester, of Nottingham; Mr. Frank Prentice and Mr. R. F. Paternoster, of Ipswich; and Mr. M. Dunn, of Selby.

Report and Accounts.

The annual report and accounts were then presented. The former gave an outline of the work of the Association during the past year; and the latter showed that there was a balance in hand at the close of £23 12s. 3d., with several subscriptions outstanding. The year began with a membership of 63, four additional members were elected, and three severed their connection with the Association under rule 17, leaving the membership at 64 on Jan. 1 last.

The chair having been vacated by Mr. Drage, it was taken, amid applause, by the President-Elect (Mr. J. T. Jolliffe, of Ipswich).

The President said his first duty was to propose a very hearty vote of thanks to the retiring President for the energetic way in which he had carried out his duties during his year of office. He was afraid Mr. Drage had been somewhat handicapped by the towns where the meetings were held, inasmuch as they were so far away from the centre of the district. That day they started under somewhat different auspices; and they had reasonable hope that his successors would not labour under like disadvantages.

Mr. W. J. Carpenter (Great Yarmouth) seconded the motion, which was cordially agreed to.

Mr. Drage having briefly acknowledged the vote,

The President read the following

INAUGURAL ADDRESS.

Gentlemen,—While deeply sensible of the honour you have done me in electing me your President, I wish that your choice had fallen upon some other and more suitable member; for, unlike many of my professional brethren, my ambition did not lead in this direction. On the contrary, I sought by every means in my power to avert such a distinction, and can only reiterate my regret at your choice. Having, however, accepted office, I will do my best to serve the interests of the Association, and shall look for your active co-operation and assistance in my efforts.

Favoured with a technical Press of exceptional merit, and to which we are greatly indebted for keeping us so well posted in all matters relating to our own and kindred industries, a presidential address becomes somewhat of an anomaly. But custom decrees that one at least shall be delivered in each year; and so I must ask you to bear the infliction with as much composure as your patience will allow. It was not my intention to have addressed you at all to-day—the understanding being that the newly-elected President should have the opportunity, if he so willed, of addressing you in the town with which he happened to be more particularly identified. I have, unfortunately, been almost compelled to break away from this, the most recently formulated rule, because of the unwillingness of the members of the Association to provide food in the shape of papers for this meeting. The Secretary, with unwearied pertinacity, has, in addition to issuing again and again the usual circular inviting papers, applied to such members as he thought might be induced to favour us with a paper, only to be refused. I need not say that if the Association is to fulfil the idea of its creation—which, as defined in Rule 3, is "to devote itself to the advancement of all matters connected with gas engineering, manufacture, and finance, and to facilitate the exchange of information and ideas amongst its members"—the members must, by the occasional contribution of papers, as well as by their presence at the meetings, show that they recognize and appreciate the advantages such an Association as this offers them. At the last meeting we were favoured with two papers of exceeding interest; but, alas! the members present to listen to and discuss them were very few indeed. This is a poor compliment to pay to gentlemen who spent their time, and took the trouble to prepare papers; and may, perhaps, in some measure account for the dearth of them at this meeting. We take a new departure to-day, and henceforward hold our spring meeting in Peterborough—a city fairly central to our district, and easy of access to most members. This new departure will, I trust, cause an increase in the average attendance, and so extend the usefulness of the society.

The year that is passed stands out in strong contrast to its immediate predecessor, and affords a striking example of the marked effect which the difference of a few degrees in the mean average temperature makes upon the industry with which we are more immediately identified; and this difference is likely to be more marked in the future, as the use of gaseous fuel extends. The Chairman of the Ipswich Gas Company (Mr. G. A. Biddell) brought this very pertinently before the shareholders of the Company in his address at their last annual meeting. He stated that the mean average daily temperature for the first three months of the year, extending over a period of 50 years, was 39°. In 1895, the mean average temperature for the first three months was 34°, or 5° below the average; while for the like period in 1896, the mean average daily temperature was 42°, or 3° above the average. Now, we all know the effect the long and continued spells of cold had upon our industry in 1895. The output of gas went up by leaps and bounds; an extraordinary demand for coke was created, whereby our coke-heaps were rapidly depleted, with a consequent rise in price; and generally it was a period of marked activity and prosperity to gas companies. It was, however, unlikely that such abnormal activity could continue without some reflex action taking place. The extraordinary demand for gas necessarily caused a large increase in the output of sulphate of ammonia; and the demand not keeping pace with the supply—or, perhaps what is more correct to say, the supply overtaking the demand—a rapid fall in its value took place. Then followed the abnormally mild winter of 1896—the mean average daily temperature for the first three months being, as I have already said, 3° above the average—and we had as complete a collapse in the value of our chief residual, coke, as it is possible to conceive, and from which it has not yet recovered. And all this was apparently brought about by the difference of some 8° in the average temperature over only part of the year.

Now, the satisfactory disposal of the residual products is no less important to the gas manager than the satisfactory yield, and even under ordinary circumstances is a matter of no small moment. But at times such as these, when there is little or no demand for his residuals except at abnormally low prices, it becomes really embarrassing, on account of the ultimate effect upon his balance-sheet. I regret that I have no original suggestion to make which might possibly enable you to deal more profitably with your surplus coke. In works of large, or comparatively large, magnitude the erection of carburetted water-gas plant offers a solution; but to most of you in this district, the adoption of such a plant is an impossibility, owing to the smallness of your works. Much can, however, be done to stimulate the use of coke as a fuel, and bring it into more popular favour, by judicious advertising, and breaking it into varying sizes to suit the public convenience. Only in grates of large size and good depth can it well be burned whole; but given

a grate of suitable construction, and you have a fuel that cannot be surpassed. I know a gentleman who has such a grate; and really his coke-fires are a picture of cheeriness and comfort, besides which he declares, from his own experience, coke to be much cheaper than coal, and a complete cure for smoke, smuts, and sweeps. But in grates of small size, it can only be burned with comfort if broken; and I find it a good plan to increase the depth of the grate by placing in the front a sort of grill made of $\frac{3}{16}$-inch or $\frac{1}{4}$-inch rod, with the rods placed vertically, somewhat similar to the "save-alls" in common use with coal fires, only made an inch or two higher than the grate, and turned slightly outward at the top. These can be made by any smith for a few pence, and, if thought desirable, given away. It is also a good plan to send out with every gas bill a small printed slip, of a different colour to the gas bill, but attached to it, enumerating the chief advantages of coke as a fuel, and the current price. We have proved this to be advantageous, and hope, by continually pegging away, to still further improve the sale.

In dealing with the residual ammonia, the gas manager seems to have devoted his attention solely to its conversion into sulphate—possibly because of the ease and facility with which it can be accomplished; and so long as this salt commanded a decent price, there was no need to do otherwise. But now that the value of sulphate has fallen so low as to yield little or no profit, it becomes a question whether we might not, with advantage to our respective companies, turn our attention to the manufacture of some other ammonium salt, or even caustic ammonia. The manufacture of ammonium chloride does not present any real difficulty, and might well be taken up by any gentleman who has already had any experience in sulphate making; and Mr. W. J. Carpenter, of Great Yarmouth, recently informed me that, from experiments which he had himself made, he was convinced that the manufacture of ammonia nitrate might also be successfully accomplished. I hope Mr. Carpenter will follow up his experiments, and at an early date favour us with a paper on the subject. The manufacture of caustic ammonia presents rather more difficulty, but it is still worthy of your consideration; and for information on the subject, I would refer you to the very able and instructive paper read by Mr. F. D. Marshall, of Copenhagen, before The Gas Institute in 1882. The objection, of course, to any of these alternatives is that they tend to complicate an already complicated industry; but I take it that such objection would have little or no influence with any gentlemen present, so long as they offered a reasonable chance of ultimate success.

The last parliamentary returns relating to the gas undertakings in the United Kingdom, like their predecessors, bristle with figures of intense interest to us all, and conclusively show that, in spite of the continued and growing demand for electricity for lighting purposes, the consumption of gas increases more and more rapidly. The total number of consumers throughout the United Kingdom in 1895, as given in these returns, was 2,659,777, against 2,524,217 in 1894, or an increase of 5·37 per cent.; and the total quantity of gas sold in 1895 was 111,444 million cubic feet, as against 105,161 million cubic feet, or an increase of 5·97 per cent. over 1894. So that not only was the increase in the number of consumers the largest ever known, but the amount of gas used per consumer was the largest on record; having risen almost continuously year by year from 34,000 cubic feet per consumer in 1882, to 42,000 cubic feet per consumer in 1895. This, to me, is a surprising fact, as I somewhat prematurely concluded that, with the large number of small consumers recently added to the roll by the introduction of the prepayment meter, the consumption per consumer would have dropped. That this is not so, is a still further proof, if additional proof were needed, of the extending use of gas for heating and cooking.

The introduction of the prepayment meter has proved of immense benefit to companies like my own, where the ratio of consumers to the population was exceedingly low. Some five years ago we had, in round numbers, about 2800 consumers on our books, out of a total population of 57,000, or, say 1 in 20—an extremely small proportion; and all our efforts to increase this number seemed unavailing. We had previously canvassed the town from house to house, sent out any amount of literature, good, bad, and indifferent, and advertised continuously; but to little or no purpose, so far as increasing the number of consumers was concerned, though it had some small effect on the quantity of gas sent out per consumer. With the advent of the prepayment meter, however, this condition of things was quickly changed. We have in five years nearly doubled our consumers; the output of gas has increased enormously; and as the applications for these meters continue to come in, it is quite probable that a few years hence the number of prepayment-meter consumers in Ipswich will be double that of ordinary consumers. Of course, there are drawbacks to this class of consumer—such as the increased amount of clerical work, cost of collection, and the disposal of the coppers. But, on the contrary, there are several advantages—such as immunity from bad debts, regularity of consumption, and cash payments. The balance, either for or against, should be, and I presume is, in all cases equalized by the amount charged in excess of the ordinary price of gas. In Ipswich, we now give 24 cubic feet for 1d.—a charge amounting to about 7d. per 1000 cubic feet in excess of the ordinary price; and for this we fix in each house four brackets, fitted with governor burners, fixed preferably in four separate rooms, and a boiling-ring. Should the would-be consumer desire to have additional burners, he is called upon to pay us the actual cost price of providing them. The average cost of fitting up each house is about 30s.; and the cost of the meter and service added to this brings up the total outlay to £4 per house. The average consumption per house is as nearly as possible 13,000 cubic feet per annum.

One remarkable fact in relation to the prepayment consumers is the regularity of the consumption nearly all the year through. Very little difference is observable in the average consumption in summer or winter; the consumption being lowest usually in March. This is probably due to the fact that the artizan who has a slot meter dispenses entirely with the use of coal or coke during the summer months; preferring to rely solely on gas, to the manifest comfort and convenience of the distressed mother of many children. It is wise and proper not to charge the whole expense attending the fitting up of these houses to capital. We place the cost of the meter only to capital; and allocate the whole of the rental of fittings to the writing down of the first cost of the fittings and the renewal thereof. By this means, we keep our capital within reasonable limits.

In the manufacture of gas, there is little or nothing new to chronicle. The most notable fact is, I think, the proved economical success, if nothing more, of inclined retorts. At Brentford where the system has been brought to a high state of efficiency, the cost of carbonization is, I believe, the lowest on record, and reflects the highest credit on the skill and enterprise of the engineers concerned. Carburetted water gas is running the gauntlet of fierce criticism, from both within and without our industry. The result of the latter will probably be to move the Board of Trade, who were already considering the matter, into more prompt action, with the consequence that we shall have still another scheduled industry—whether with any advantage to the community, time will decide; but, personally, I have strong objection to so much grandmotherly interference. The criticisms from within are valuable so far as they go. They do, however, but show that there are, as we may have expected, certain places, and possibly districts, where no pecuniary advantage will accrue from the introduction of carburetted water gas as at present manufactured. But whether there may not be other collateral advantages outweighing any pecuniary loss, I am unable to say. It is certain we can neither ignore nor minimize the success attending the installations already in existence. The success of the installation at Tottenham has been phenomenal. You will, I am sure, regret with me that our friend Mr. Pike was, through ill-health, and other circumstances over which he had no control, prevented from giving us the results of the working of his water-gas plant at Colchester during last winter. To the same regrettable cause is due his absence to-day.

The subject of condensation has of late been rather prominently brought to our notice—first, in Mr. Browne's presidential address at the Southern District Association in February, 1896; later in the year by the valuable paper read by Mr. Young before the North British Association; and still later by the interesting results communicated to this Association by Mr. Shadbolt at our last meeting. If we look very closely into the published records relating to this question of condensation, it is astonishing after so long a time how little we know of the physical effects produced on the gas by the process of condensation, other than the actual lowering of the temperature due to more or less exposure, and how few are the rules of real value laid down for our guidance. It is true the text-books give us one or two empirical rules as to the superficial area, &c., required; but as these rules are unaccompanied by any observations as to the conditions under which different sets of condensers work, they are practically valueless. The most important attempts made to solve the problems attached to condensation were the experiments conducted under the initiation, and at the expense of, The Gas Institute in 1882. These results were valuable and interesting so far as they went; but they neglected altogether to touch upon the important problems recently opened up by Mr. Browne, and enlarged upon in the correspondence in the "Journal of Gas Lighting" between that gentleman and Mr. Young. The importance of these problems to us all is seen in Mr. Browne's experiments, when, by the addition of an enricher to the gas at the inlet of the condensers, he obtained an increase in the luminosity of the gas far in excess of the amount due to the volume of the enricher itself, and a diminution in the deposition of naphthalene which he reasonably accounts for by the solvent action of the enricher on the naphthalene itself. And it is also seen by the experiments of Mr. Shadbolt, who obtains an increase of about 2 candles in the illuminating power of his gas by the simple device of returning a certain percentage of the partially purified gas to the inlet of his condensers, having previously raised the temperature of the gas so returned to the temperature of the crude gas at the point of contact. It is difficult to satisfactorily account for this increase. But one must accept and welcome it as an accomplished fact; and I trust that the discussion on the subject of Mr. Shadbolt's paper which you are to have to-day will prove both interesting and exhaustive.

Purification to-day, where the reduction of the sulphur compounds is a matter of legal obligation, seems to be reverting, or has in many cases already reverted, to the method in vogue many years since—viz., the rotation system, with the addition

of a varying percentage of air admitted at some convenient spot—and I merely refer to the subject now to point out that what was considered by many an impossible system twenty or more years ago, is now recognized and successfully practised. Personally, I can testify that during the whole time I was in charge of a large works in the North of England, it was found quite possible to keep the sulphur compounds within reasonable limits by the ordinary rotation system of purifiers, without any recognized quantity of air being admitted—and, indeed, where every effort was made to avoid the accidental admission of air, by mechanical safeguards of extreme delicacy. And I am strongly of opinion that, given purifiers of sufficient capacity, no addition is necessary. But while holding this view, I am none the less sure that the addition of a measured quantity of air proportionate to the quantity of sulphuretted hydrogen in the gas, admitted at some suitable point, materially assists the purifying material in doing its work, and has no injurious effect on the luminosity of the gas.

Probably more injury is done to the gas industry by faults and imperfections in the distributing plant than by any other; and by the distributing plant, I mean not only the mains and services, but the internal fittings of the houses also. It is almost impossible for the ordinary consumer of gas to distinguish between quantity and quality; and the inevitable result of a deficient or faulty supply is the pronouncement that the gas is bad, with sometimes an expletive not usually recognized in polite society thrown in to emphasize the fact. Far be it from me to say that gas engineers do not, as a rule, maintain their distributing plant in a state of efficiency equal to that of the manufacturing plant; but I have known, and probably you all have known, instances in which the reverse has been the case, with untold grumbling as a consequence. In addition to this, there is the all too common effect traceable to the too close observance of what is sometimes referred to as one of the golden rules for gas managers—viz., keeping down the pressure. Now in these days, when gas-stoves and gas-fires are in common use in every household, a good, and indeed what was a few years ago, and perhaps may be by many even now considered a high day pressure, is absolutely necessary if this class of apparatus is to work satisfactorily and well. To stint and cut down the pressure below what is actually necessary to meet this class of consumption is, in my opinion, not the best way to command success; and there is no possible justification for doing so, inasmuch as it has long since been proved that high pressures and heavy leakage need not necessarily go together.

But perhaps the greatest trouble of all to the gas manager is the complaints clearly traceable to the *laches* of the jobbing gas-fitter, and for which we are too often blamed. It is too late in the day, even if it was desirable, which I very much doubt, to attempt to obtain parliamentary powers scheduling the sizes of pipes, as is the rule in some towns of Scotland. Therefore, the best remedy for the evil is, in my opinion, for the gas companies themselves to undertake the gas-fitting business. We started doing this many years since; and we have gradually built up a large business, with marked advantage to the consumers and the Company. We keep a staff of skilled gas-fitters, under a capable outdoor superintendent, whose business it is to follow up all complaints, have them remedied, and, in addition, advise and consult with the consumers whenever any alterations and additions are possible or necessary. This has a double advantage, inasmuch as we not only remedy the evils and prevent further troubles, but also keep ourselves in close touch with the consumer. With a view to minimize the trouble and annoyance caused to the consumer, consequent on the failure of the gas supply through the blocking of the service-pipes, we have paid especial attention to the cause of the deposition of naphthalene; and the results of our observations lead us to the conclusion that the deposit is directly attributable to the presence of the watery vapour in the gas after being stored in the gasholder over water—the immediate exciting cause being the sudden cooling of the gas when passing through the very shallow or exposed services, and were it possible to properly desiccate the gas, naphthalene crystals would not be deposited. This not being practicable, the best preventative is to lay the mains and services sufficiently deep, and especially to guard the latter from being exposed at any point; and, further, to lag and box the services or meter connections where they enter the house, should they be placed near a window, grating, or opening of any kind. By such precautions, we have reduced the number of stopped services to a minimum; and we hope for even better results. As a further means to this end, we take all services off the side of the main, instead of from the top, thereby insuring so much greater depth.

It is probably known to most of you that the whole of the streets in Ipswich are now lit by incandescent burners. We have over 1200 in use; and so far they have been an unqualified success. Strangers visiting the place pronounce it the best lit town they have ever seen; and I am sure the testimony is true. We first experimented with this system of street lighting in the severe winter of 1895; and from the experience then gained, we were able to fix the probable number of mantles necessary for renewals at six per lamp per annum. On this basis we entered into a three years' contract with the Corporation, and have found it to work very satisfactorily. It is probable that less than six mantles per annum might suffice; but I think it is to the general advantage of the community not to cut the number too fine, as there is a considerable decrease in the lighting power of the mantles after long and continued use. I do not wish you to understand that no trouble or difficulties attended the introduction of this system of lighting; but in this, as in everything else, difficulties arise only to be overcome. While some mantles have done serviceable duty for a whole year, others have failed quickly, owing to various causes, which we have had to discover; and in one case the number of mantles needed for the year was nineteen. But these are exceptions; and by careful observation and sundry small devices, we have overcome most of the difficulties.

The introduction of these burners into the street-lamps has done much to satisfy the cry for improved street lighting; and if this was the sole benefit, we should feel it was an ample return for our speculation. With the advent of the Denayrouze burner, we have the promise of still higher efficiency. This improved burner, it is stated, gives a light of 150 candles for a consumption of something under 9 cubic feet per hour, or 17 candles for each cubic foot of gas burnt. It has the further advantage that it can be used without a chimney; and they say that the mantles last much longer. In groups of three or five, the lighting is very effective; and the groups of burners recently exhibited at the Royal Aquarium, in my opinion, totally eclipsed the electric arc lights adjoining—a very marked example of lighting effect as against illuminating power, because while the gas-burners were only supposed to give a light equal to 750 candles, the arc lights are credited with anything up to 2000 candles.

The Corporation of Ipswich have, like many other municipalities, caught the trading craze. They have just obtained a Provisional Order, and contemplate spending some £40,000 on an installation of electric lighting. Probably this scheme, like many others, will, if carried out, result in a loss to the Corporation; and surely it is the irony of fate that the Gas Company should be called upon to help to find the money, through the rates, to make good any deficiency. But so it is; and it would be as profitable as tilting at windmills to do aught to oppose the scheme. As a gas company, we do not oppose electric lighting. On the contrary, we welcome it as a splendid testimony to the science of the day, and as a possible aid in the extension of our own business by increasing the demand for more light. And to show that we have faith in our belief, we are prepared to undertake, and satisfactorily instal in any premises in the borough we serve, a complete installation of electric lighting; offering the same facilities as to payment as we should do were we negotiating the sale of a gas-stove.

Mr. CARPENTER moved that the hearty thanks of the members be tendered to the President for the excellent address which he had delivered. The address, he remarked, bristled with information; and it was evident that a great deal of trouble and care had been bestowed upon its preparation.

Mr. W. J. BEST (St. Ives), in seconding the motion, observed that most local authorities were now anxious to see incandescent lights installed in their streets; and he hoped that at a near time the question of the arrangement of terms between gas companies and local authorities for these lights would be thoroughly threshed out.

The motion was unanimously carried.

The PRESIDENT thanked the proposer and seconder of the vote for the kind remarks they had made, and also the members for their hearty acquiescence in them.

THE SELF-ENRICHMENT OF COAL GAS.

The PRESIDENT called on Mr. R. G. Shadbolt, of Grantham, to open the adjourned discussion on the paper he read, upon the above subject, at the last meeting.*

Mr. SHADBOLT said he had come to the conclusion that the best course for him to take would be to open the discussion on the original paper by bringing out its salient features, rather than by reading a supplementary one. It appeared to him that there existed an amount of confusion between the original set of experiments mentioned in the paper as having taken place at Low Moor, and what he chose to term the corroborative tests which had been made at Grantham. Why this confusion should have arisen, he could scarcely see, unless it was this—that, in the case of the experiments at Low Moor, he gave some rough sketches to illustrate what was then done, while with regard to the tests at Grantham, he gave nothing but what was written. The fact remained that many people (possibly through not having read the paper thoroughly, or through local conditions of which he had no knowledge) had been led to interpret the results of his experiments in this way—that thoroughly purified gas was returned to the foul main; and that, by means of a steam-jacket, or some other equivalent, the temperature of that gas was raised approximately to that of the gas in the foul main. These conditions applied to the first set of experiments at Low Moor only. They had an illustration of this in the interesting correspondence which took place between Mr. Martin, of Ormskirk, and himself on this question. There they had an instance of a gentleman who had entirely misunderstood his (Mr. Shadbolt's) meaning. He did not say Mr. Martin misrepresented the matter at all; but he did misunderstand it. He apparently failed to grasp the difference—and it was the fundamental difference—between returning

* The paper was published in the "JOURNAL" for Sept. 22, 1896.

thoroughly purified gas, and gas at the stage of manufacture described in the paper. A friend of his (Mr. Shadbolt's) who took a great interest in the paper, he was astonished to find had a 3-inch main running along by the foul main the whole length of the bench, and inside this he had a 1¼-inch gas-pipe—the annular space between the two being filled with steam from the boiler. He had got a steam-jacket, and was also returning gas in too pure a state, through confounding the first set of experiments, and losing sight of the subsequent tests. Another gentleman who had made attempts with this method of enrichment had found, very strangely, that every time he turned on the returning gas, instead of securing an increase of illuminating power, he actually had a decrease. This proved the thing had been wrongly applied; and, guided by the results laid down in the paper, the cause was not far to seek. He desired to say, however, that he did not wish the members to think that he attributed any mental density to the gentleman to whom he had referred; he simply quoted these cases to show that his paper had been misunderstood. He wished to distinguish between the two sets of experiments—those carried out at Low Moor and Grantham respectively. In order to do this, he would first read the fourth paragraph of his paper—*i.e.*, "Without going into details," and ending at "a practical test." Having read the paragraph, he said that it would be seen he was there dealing with the original idea of returning thoroughly purified gas to help to carry forward the enriching vapours that existed in the hydraulic and foul mains. "For the sake of clearness," the paper proceeded, "it will perhaps be better to divide the treatment of the returning gas into two separate heads—viz., from whence returned, and the point returned to. Dealing, then, with the latter first, it was deemed advisable to intermingle the crude and returning gases at as early a stage as possible—having due regard to convenience—and also to provide the returning-gas tubes with steam-jackets or other equivalents immediately prior to the introduction of the returning gas into the foul main; the object being the approximation of its temperature to that of the crude gas." He wished it to be clearly understood that this was *purely speculative;* and this was where some people had made a mistake. He was dealing there with the experiments at the outset. Having read the succeeding paragraph in the paper, Mr. Shadbolt, dealing with the question as to the point from which the returning gas should be drawn, said it then occurred to him that, if thoroughly purified gas was returned, the increased quantity of gas so passing through the purifiers in the winter time would cause increased back-pressure on them; and therefore the inlet side of the purifiers was tapped to avoid this. It was not that the original idea was departed from in favour of some other, but on account of the probable increase of back-pressure; and this was how the first point was fixed from which the first highest result was obtained. Mr. Shadbolt next read the paragraph ending with the words: "Now it was while the beds A were working and beds B being prepared, that the maximum illuminating power of 19¼ candles—being an addition of 2½ candles—was reached; but after transferring gas-making operations to beds B, 17½ candles, or an addition of only ¾ candle, was the greatest increase obtainable."* This, he continued, was the first difficulty met with. After having realized 19½ candles, when working the three beds A, and introducing gas at the point 1, and finding, after letting down these and lighting up the two beds B, the same illuminating power could not be obtained as previously, he, of course, began to make an effort to find out a reason for this. Then came the first alteration in the point of introducing the gas. The idea that occurred to him was that, when they were introducing gas at this point, with a length of foul main comparatively cool, the gas cooled somewhat, and also that, coming in a body as it were down the 12-inch pipes, it would go very strong, and perhaps mix more completely than when the gases intermingled at point 1. It seemed to him possible that with the stream of gas issuing from the 6-inch pipe, and the gas impinging upon that stream, there might be some amount of friction, which would cause precipitation of the hydrocarbon vapours it was so desirous to retain. This induced him to change the point of introduction from point 1 to 2, thus allowing the gases to intermingle more gradually. But though a candle (and on one occasion as much as 1½ candles) increased illuminating power was obtained, it was still very uncertain in its action, and quite uncontrollable. Under apparently the same conditions, one day the illuminating power would be up, and the next down. He again turned his attention to the point from whence the returning gases were drawn—from the clean scrubber outlet. The thought then occurred to him that possibly the original idea of returning thoroughly purified gas had not been sufficiently adhered to; also that varying proportions of remaining impurities contained in the gas after its passage through the scrubbers might, to some extent, account for the fluctuations in enriching results. With the view of once and for all setting the matter at rest, gas was returned from the station-meter inlet. But he was astonished to find that, instead of obtaining an increased illuminating power, he robbed his gas of part of that which it already had. *After this*, they connected up the meter which registered the returning gas to almost every part of the works, so that they could return gas at every stage of manufacture from the condenser outlet to the station meter; and having tried returning gas from these points, they found that, in mid-summer, when they were only making gas from two beds, with that particular make, they obtained the best results, which were almost identical with those previously mentioned from gas returned from the inlet of the second scrubber. This showed there was a point where a certain proportion of oil vapours were contained in the gas, which point went backwards and forwards with the quantity that was being made. It was through this experiment that they found it receded backwards with a small make of gas. Up to this point, these must be considered as experimental tests or investigations. No *final* importance must be attached to them, any more than their bearing on the question under consideration. When returning the gas from the second scrubber inlet, they obtained results identical with those secured in the first instance; but after a few days, the same variations with which they had been previously troubled made their appearance. Therefore to decide the matter, they placed thermometers in the streams of foul gas issuing from the hydraulic mains, and that returning from the scrubber just prior to it entering the foul mains. They maintained the temperature there to about the mean of that of the foul gas. After doing everything that could possibly be conceived at the time, they found they still had the variations in the illuminating power. After taking a number of observations hourly, they found a peculiar thing—that the higher the temperature of the gas issuing from the hydraulic main, the lower the illuminating power eventually obtained. This was probably brought about by the greater variation at the higher temperatures found there. It was also noticed that, whereas the gases from one bed, might be hottest at one part of the day, using the same coal from the same truck, and under identical conditions, before night it would be reversed. Taking the temperature over the whole day, it was found that it varied considerably, comparing one day with another; and this was attributed to some extent to atmospheric conditions. When the position of the retort-house was taken into consideration, doubtless the mean temperature of gas from beds A was lower than from beds B, and might be the reason why they obtained better results from beds A; also that the gas containing the oil vapours which was returned to mix with the foul gas from the hydraulic main, was issuing at a much lower temperature, due to its travel along the cold foul main. So far they had been simply testing these matters. Having removed to Grantham, he commenced as early as possible to apply his acquired knowledge there; and he might say that the enriching method as applied there was in existence to-day. The point of introduction, and the point from which the gas was drawn, were fixed from the knowledge gained from the experiments he had carried out at Low Moor; and they had remained exactly as they were now. They commenced experimenting at Grantham at the beginning of last year; and as the make of gas decreased—when it reached about half the maximum—they did not obtain the same enriching results as previously. Without any more ado, they took the returning gas from the washer inlet, instead of the washer outlet; and instead of returning it to the point they had been doing, they took it half-way back on the foul main towards the retorts, and also at the same point took off the thick tars that were flowing in the same direction as the enriching gas. So far as Grantham was concerned, at the present time the system was under perfect control; and his experience during last winter simply corroborated what was said in the paper. He had come across little things which he thought would lead to some slight further improvement. One or two gentlemen had written to him saying they were anxious to see the enricher working. There was nothing working; they could simply see the arrangement. It had not been working fully except in the depth of winter. The carbonizing plant was restricted in character; and to enable them to eke out their make to the best possible advantage, about two weeks before Christmas they put on the enricher in full, and up went the illuminating power to 19 or 19½ candles. By its means, they were able to maintain the quality and pressure of the gas throughout the whole of the recent winter. They had to pay a fair price for coal at Grantham; and, when he went there, they were using a great proportion of Derbyshire coal. He thought it unadvisable, seeing they had such a restricted carbonizing plant, to continue the use of this coal. They therefore went in for the best South Yorkshire coal they could get, so as to increase the make, instead of the plant, for that winter. In this way, they secured an increase in illuminating power of 1½ candles; and this was the only reason the enricher was discontinued for a time. With regard to the question of permanency which had been raised, he thought this was proved fairly well by the figures in the paper. As he had only used the enricher at the heaviest part of the year, he could not well spare a gasholder for storing the gas for weeks or months. He might, however, mention that they had No. 5 burners in the street-lamps, and no sooner did they put the enricher on, than they had complaints about the lamp-glasses being extra sooty. Its permanency, judging by rule-of-thumb standard, was as good as ordinary coal gas when enriched by cannel. At the last meeting, one or two questions were put to him. One was the different effects that might be expected by changing the quality of the coal. Mr. Jolliffe suggested that the coal he had been using was of a different character to that which the members

* See illustration in "JOURNAL" for Sept. 22 last (p. 546).

generally used, and contained more benzol than Durham coal. During the working from mid-winter to mid-summer, they were using one-eighth Durham coal, three-eighths Derbyshire coal, the remainder South Yorkshire. The coal was not delivered in regular quantities. Consequently, some days they would be working Derbyshire coal, which he found worse than the others for enriching results; but Durham coal he found to be good. The point at which the gas was introduced, the point from which it was drawn, and the quantity or proportion returned, were the three factors in obtaining good results or otherwise, and would each vary with local conditions. By proper adjustment, they could obtain the same enriching results with various coals. One thing mentioned in the paper was this, that when they were using the enricher, there was no accumulation of oil in the washer; but when they were not working it, they had oil. At Retford, Mr. Child asked a question as to the character of the oil. He had with him a sample of the oil in question. The oil was the result of condensation in a 90-feet length of 2-inch wrought-iron pipe. It was of a peculiar character; and evidently contained a great proportion of benzol and naphthalene.

Mr. W. R. CHESTER (Nottingham) asked the exact point at which the oils were collected.

Mr. SHADBOLT replied at the point immediately prior to the entrance of the gas into the foul main. The vapours they might take it that did the work were somewhat lighter.

Mr. CHESTER: The collection is from gas from the inlet of the second scrubber?

Mr. SHADBOLT: The outlet of the washer. The relative positions of the apparatus are condenser, exhauster, washer, and two scrubbers. This is after the gas has passed through 90 feet of 2-inch pipe.

Mr. CHESTER: Were these oils taken during the time the enricher was at work?

Mr. SHADBOLT: Yes.

Mr. CHESTER: The condensation was very imperfect at that point.

Mr. SHADBOLT: The condensation was very good. With the condenser, they had a ¾ million cubic feet Livesey washer, and a maximum make of 400,000 cubic feet per day. There was very little tar in the liquid; it was mostly oils.

[In order to indicate the character of the oils, Mr. Shadbolt, by means of a temporarily fitted arrangement, heated a portion in a flask, the resulting vapour passing to a pipe supplying gas to an ordinary No 3 burner. Compared with a similar burner using ordinary gas alone, the light afforded was certainly far richer.]

Mr. SHADBOLT, in concluding his remarks, said there was one little experience with naphthalene that he should like to mention. The first year he was at Grantham, the largest make he could obtain when using one-eighth Durham coal and three-eighths Derbyshire coal, and the remainder South Yorkshire, was 400,000 cubic feet of gas in 24 hours. They had twelve beds of seven single retorts. In the case of six of these, the draught was derived from what they called the big chimney; and for the remaining six the draught was obtained from a small temporary chimney. The result was they could never get the latter six beds above a good blood-red heat. To improve matters, they put all the settings on the larger chimney; and they also did away with the use of Derbyshire and Durham coal. From tests made in the summer, they found they could get some 500 cubic feet more, on an average, from a ton of coal, compared with what they could do previously. After using the enricher, with all the beds on, with greater heats, and a better average quality of coal, they could not reach 400,000 cubic feet per day. This led him to test the meter against one of the gasholders; and he found it was more than 3 per cent. fast. The only solution he could offer was that the meter must have been pretty nearly choked up with naphthalene; and these light oil vapours must have dissolved it out, as it had done in the case of the service pipes and mains. As it dissolved, the meter would naturally register slower.

The PRESIDENT observed that they had had some interesting remarks from Mr. Shadbolt; and coming as they did upon an exhaustive paper in September last, the members ought now to be in a position to thoroughly discuss the subject.

Mr. W. D. CHILD (Romford) said Mr. Shadbolt appeared to have been under some idea that the readers of his paper would not be very clear on the subject—at all events, their thanks were due to him for having made them so well acquainted with the line of reasoning that led him into his researches in this direction. Mr. Shadbolt had alluded to the fourth paragraph of the paper; and he (Mr. Child) thought that there he had put the whole gist of the subject before them in very logical and plain form. Reading it himself, he felt he was very much in accord with the writer, and that it left him very little to discuss, excepting perhaps one or two points in the method of treatment. First of all Mr. Shadbolt fully informed them of failures and troubles he experienced in prosecuting his researches before he was able to fix the point at which he could withdraw the gas for returning to mix with the crude gas. Then he ultimately settled on the outlet of the washer. They had, then, to consider whether this was the most favourable position from which to withdraw the gas, which had only been subjected to the process of condensing and washing. They might take it, he thought, that, in the process of condensing, the gas was deprived of some heavy tarry matters. In washing, a considerable proportion of the sulphuretted hydrogen and carbonic acid would have been removed from the gas; and thus it would have been considerably altered in density by being deprived of these constituents. It would therefore be more valuable when returned and mixed with the crude gas for taking up and retaining the lighter hydrocarbon vapours. Another point that struck him was as to why it was desirable to take the gas from this point, because, if the gas was carried forward into the dry purifiers, it was very possible it would be deprived of its bisulphide of carbon. Now this gas was one of the greatest solvents of hydrocarbons; and it was the retention of this particular body in the gas returned to mix with the crude gas that effected the desired result, by acting as a dissolvent of the hydrocarbons that were in the mixed gas, and enabling them to be picked up and retained, and carried forward with the general current of gas. This, he thought, explained the reason why it was not desirable to go farther forward. Mr. Shadbolt had made several experiments on this particular point. He had left nothing to chance. He had gone forward as far as the station meter; and they might take it that he had satisfied himself as to the proper point. The suggestion he (Mr. Child) had made as to bisulphide of carbon might be the reason why it was desirable to stop at this particular point—before the dry purification. Mr. Shadbolt's first tests at Low Moor were made by returning the gas at the junction of the foul main with the hydraulic; and he ultimately recommended returning it to the inlet of the condenser on account of the difficulty experienced in keeping the returned gas at a similar temperature to the crude gas. He would have done better he thought if he had persevered still more, and mixed the gas at an earlier stage of its manufacture, by returning it into the foul main, or even into the hydraulic main itself. The difficulties of varying temperatures might have been overcome, not by relying upon a steam jacket for warming the returning gas, but by running the pipe returning the gas into the foul main, or by making a coil in the hydraulic main. By surrounding the pipe containing the returning gas by the crude gas, it would have been brought to an equal temperature to the latter. As to the results obtained by the use of different proportions of returned gas, Mr. Shadbolt had marked the percentages "A," "B," "C," and so on. He did not tell them what these percentages were. The best results were obtained when using the largest proportion of returned gas; but to his (Mr. Child's) surprise, Mr. Shadbolt told them that there was a limit to what this proportion should be. Otherwise, he should have anticipated that, beyond studying practical convenience, there should be no limit, and that the larger the proportion of semi-purified gas that was returned to mix in the hydraulic main, the more likelihood there would be of picking up a higher proportion of the light-giving hydrocarbon vapours. Mr. Shadbolt estimated the cost at 300th of a penny per candle per 1000 cubic feet. In the statement he placed before them, he showed that 0·0996 (or, say, one-tenth of a gallon) of tar was used for each candle increase of illuminating value; and he valued the tar used at 25s. per ton, or 1½d. per gallon. The analysis made by Mr. Chester of the tar produced in ordinary working showed (what might be reasonably expected) that the enrichment of the gas was brought about by depriving the tars of the benzols and those constituents that were most valuable to the tar distiller; and he thought, if this process were more generally adopted, that they could not expect to receive the same price for tar as at present. They were getting very little now; and he was under the impression that, if this system were carried out, they would get still less. In fact, he thought that—taking the comparative values of the products obtained from coal tar, and the gross value of the tar itself—it was very probable the cost of enrichment might be estimated to be about ¼d., instead of the figure given by Mr. Shadbolt. As it cost, according to the statements of those who used paraffin oils and other things for enriching gas, about double this amount for enrichment, he thought Mr. Shadbolt might be satisfied, if he enabled them, by the result of his labours, to enrich gas to the extent of a candle for ¼d.

Mr. CHESTER thought the Association was to be congratulated on having had such an admirable paper placed before them as that which Mr. Shadbolt read last year; and that gentleman was also to be congratulated on the courageous way in which he had attacked a subject which was perhaps one of the most fascinating in connection with gas manufacture, and also one of the most elusive. As Mr. Shadbolt said in his paper, it involved a vast amount of work, time, and care, in order to be quite sure that the results were real and not imaginary. The question of condensation and the retention of the illuminating hydrocarbons in the gas, had been one which had occupied the attention of gas engineers perhaps on more frequent occasions than any other subject during the last twenty years; and there had been a great number and variety of methods adopted to try and secure this end. Mr. Shadbolt appeared to have carried the thing to a more concrete result than many other gentlemen had been able to do; and it was on account of this that he (Mr. Chester) thought he was especially to be congratulated. He imagined, and no doubt Mr. Shadbolt would himself agree, that after all he had only touched the fringe of this very important subject, and that he had still much to learn, and much to demonstrate before individual gas engineers were able to follow him, and be quite sure they were going to obtain the same kind of results when their experiments were put into operation. The point at which the gas must be returned, and from which it was taken,

must vary largely in every gas-works, because the apparatus was so different between these two points. As an instance of this, they had the enormous difference in the condensing area as applied at Low Moor and Grantham. In the one case 10,000 superficial feet, as against 920 feet at Grantham. It was this point that struck him as curious in producing such a large quantity of condensate in a separate pipe at Grantham, while showing no signs of it at Low Moor. If the condensing power at Grantham had been adequate to the requirements, there should have been nothing like the quantity of oil that Mr. Shadbolt was able to obtain in a 2-inch pipe. Certainly this portion ought to have been kept in the gas. He remembered another system that was put into operation some years ago, mainly with the object of obtaining similar results in a different way—the idea being to retain the light hydrocarbons in the gas, instead of having them carried down with the heavier tar deposits. The effect which Mr. Shadbolt obtained by returning some of his gas and making it the carrier, was in this instance secured by placing steam-pipes in the centre of the condenser which ran horizontally all round the retort-house, and so maintained the temperature of the gas over a longer course than would have been the case in the ordinary way. By this means, the lighter hydrocarbons were not thrown down, and no semi-purified gas was required to retain the illuminating power. By this method, a considerable increase in illuminating power was realized; and he believed the process was still in operation. He might say with regard to Mr. Shadbolt's experiments, that he (Mr. Chester) had taken a great interest in the matter; and, as far as one could judge, there was no reason whatever why the system should not be successful. But he was bound to say he had not carried it to a success himself. In all probability, this was due to some error in the point at which the gas had been taken and the point at which it had been returned. But if anybody took a sample of coal, and tested it in the retorts twenty times, he would get twenty different results. There would be a difference in the quantity of gas, in the illuminating power, and in the production of tar, ammonia, and impurities. No absolute and reliable result could be obtained unless one extended the experiments over an enormous number, and determined the exact conditions, and saw they were maintained in every experiment. He noticed in Mr. Shadbolt's paper a want that ought to have been supplied. No mention was made of the quantity of gas he produced during the period of time referred to. It was well known that, by slightly varying the quantity of gas made, it was an easy matter to get an increase of illuminating power, or by increasing the production to get a decrease of illuminating power. It seemed to him that the absence of figures as to the make was an important thing. The fugitive character of the results was such as to make it exceedingly difficult to arrive at any concrete basis; and although they might try, he thought it was not unlikely they might have great difficulty in realizing the results which Mr. Shadbolt had been able to produce. There was the case of the Widnes experiment. Although results were being obtained there (and they were results which every one might expect would follow), yet it had been a most difficult matter for anyone outside the Widnes Corporation to repeat these results; and it would also be a difficult matter for anyone to repeat the results which Mr. Shadbolt had obtained—not that the results were doubtful, or that he had any doubt in his mind as to Mr. Shadbolt having obtained the best results. But the conditions varying so widely—the coal being distilled under different conditions every day of the year—made it exceedingly difficult to rely with any absolute certainty on getting any particular results in experiments of this nature. He thought Mr. Shadbolt had been very courageous in tackling a subject of this kind—perhaps one of the most difficult in connection with gas manufacture.

Mr. CARPENTER said he came to the meeting with the firm idea that, if this process would produce anything, it would be naphthalene; but Mr. Shadbolt had assured them that it did not do so. He (Mr. Carpenter) thought that the returning gas would take up vapours, and deposit them in the distribution system. Coming to the end of the paper, Mr. Shadbolt stated that it was applicable under widely different conditions; and he also gave the quantity of oil he produced at Grantham. At Great Yarmouth, he did not produce much oil, so their tar distiller said—in fact, he might say the tar was considered to be a poor one. They left very little oil in it; and, comparing it with the analysis in the paper, they had only about a quarter of the naphthas and light oils that the Grantham tar contained.

Mr. CHESTER: This particular tar was drawn from the inlet of the condenser.

Mr. SHADBOLT: You see the tars were taken from the condensers entirely; sample "A," in the analysis, being slightly richer in benzols than "B."

Mr. CARPENTER: You get a loss of 8½ per cent. in the light oils and naphthas that you take from the condenser tars, and yet the analysis given of the tar states that it is practically of equal commercial value.

Mr. SHADBOLT: With and without enricher.

Mr. CARPENTER: You have enriched your gas at the expense of the tar.

Mr. SHADBOLT: Quantity only. The quality is practically commercially the same.

Mr. CARPENTER said that seemed to him to be rather extraordinary. If they took 8½ per cent. of the condenser tars, then he should say that surely they must give the tar credit for a little more than that. The analysis of their tar at Great Yarmouth showed that it contained so little naphtha and light oils that he did not think this process was so generally applicable as Mr. Shadbolt thought. It appeared to him (Mr. Carpenter) that they would not find it so. It must vary according to the quality of the coal. They used Newcastle coal, and produced a great quantity of gas from it; and then they enriched it. If, however, they could enrich it by a process of this kind, and make the same quantity of gas as they did now, then they would achieve something. Taking another point as to the naphthalene, he thought the sample shown by Mr. Shadbolt, and which was deposited from the returning gas, was evidence that there was a good deal of naphthalene originally in the Grantham gas. If Mr. Shadbolt could produce a gas containing a good deal of naphthalene, and then by adopting a process of this sort, keep his mains clear, and maintain the illuminating power to the end of his system, he would have done a great deal.

Mr. T. A. GUYATT (Ely) said he had been looking into this system; and had hoped to have had the arrangement fitted up by this time. But other things had come in the way; and he had not been able to complete it. He had been to Grantham twice; and Mr. Shadbolt had put his photometer at his disposal. He had not the exact figures with him; but, on the first occasion (when the enricher was not at work), the illuminating power was 17⅓ candles. On the second occasion, when it was at work, the illuminating power was 18½ candles. With ordinary coal, 17½ candles was a very high illuminating power. But the heats then were rather low, which probably explained the result mentioned; and, as Mr. Shadbolt informed them, he was using the best South Yorkshire coal. The heats were better when he visited the works the second time; and the illuminating power was a candle more. He also saw the oil which Mr. Shadbolt had collected, and which had been standing some time. There were crystals deposited in it; and they seemed to him to be pure naphthalene.

Mr. H. WIMHURST (Sleaford) remarked that, if Mr. Shadbolt could enrich their gas one or two candles for anything like 1d. per ton of coal carbonized, they would, he thought, have reached a very happy state.

Mr. F. PRENTICE (Ipswich) inquired the method adopted for taking the illuminating power.

Mr. TROUGHTON asked whether Mr. Shadbolt had any experience with naphthalene either at Low Moor or at Grantham when he was not using this enriching process; and, if so, whether he found, if naphthalene existed in the mains and services in any part of the district, that during the time the enricher was at work, it disappeared altogether or partly.

The PRESIDENT announced that Mr. Barton had prepared a short account of an experience he had had with naphthalene; and this would be a convenient opportunity to introduce it.

Mr. BARTON read the communication, which is given on the following page. Referring to Mr. Shadbolt's paper, Mr. Barton added that there was one point which struck him, and that was the temperature of the gases. They all knew what a difficult matter it was to keep the gas at anything like a uniform temperature in the winter time. It was in the winter that this enriching process seemed to be required the most; and this question of temperature appeared to him as being a weak point, if he might so term it. Beyond this, however, he had every reason to believe the system was a good one; and he trusted it would not stop where it was now.

Mr. SHADBOLT, in replying to the discussion, said Mr. Child had suggested that probably the bisulphide of carbon had some effect in absorbing the hydrocarbons. This was an idea that had not occurred to him (Mr. Shadbolt); but looking at it on the spur of the moment, he did not think it was at all logical, because, if it were the prime factor, it would apply at any point (practically) between the condensers and the purifiers, seeing that only a very small proportion of the bisulphide of carbon was removed between these two points. If he exceeded this particular part where he obtained the vapours, he did not get the same enriching effect. As to returning the gas to a point near the retorts, and using the heat of the foul gas to raise the temperature of the returning gas, they found that it was deleterious to the final result to heat the returning gas in any way whatever until it got into the foul main. If heat was applied by means of a steam jacket, it was in time of frost, when they wanted to keep the temperature above 32° Fahr. He started with the idea of heating the returning gas; but he obtained better results at a lower temperature. If the returning gas was admitted into the foul main where the temperature of the foul gas was at anything over 140°, the enriching results decreased as the temperature increased. The percentages of the returned gas he did not give, because they would be misleading. In the specification of the patent, he said "10 per cent. more or less." "A," "B," and "C" were different percentages with his own gas; but they might not apply to any other. Local conditions varied to such an extent that one could not prescribe generally. Regarding the point as to the cost of enrichment, and the reduced quality of the tar, which would affect its value, as he pointed out previously it was only the condenser tar which came into question. He had it on the authority of Mr. Chester, as contained in the analysis given in the paper, that the commercial value of the tar was little, if any, different. When he

told them that they had the name of sending thinner tar than ever from Grantham, there was really little to be said on that point. (Laughter.) He thanked Mr. Chester for the kind things he had said. Respecting the oils, he would say this of Low Moor, that he did not get so far there as abstracting the oils in the form shown that day. Certainly they had the light vapours; and it was there that he determined he could not do any good without them. It was the thermometers placed in the returning gas, that first gave him an inkling of the existence of these vapours. He noticed a pitchy glaze on the thermometer cases. They were making somewhere about 150,000 cubic feet of gas a day, with plant—condensers and scrubbers—capable of dealing with a million cubic feet, when he found this pitchy glaze on the thermometer cases. He was rather astonished, on allowing the gas to blow gently out of a small pipe, and impinging on blotting-paper or wool, to find a distinct show of oils. Respecting the capacity of the condensers, perhaps the title was a little misleading, because the returning gas was generally returned from the outlet of a Livesey washer. When comparing the condensing power proper at Low Moor with Grantham, they must add a ¾ million feet washer to the condensing power at Grantham; and this would bring them about the same. With reference to a steam-pipe in a foul main having the beneficial effect mentioned by Mr. Chester, he thought Mr. Armitage, of Lancaster, made that point in his address when President of the Manchester District Institution of Gas Engineers.* But he (Mr. Shadbolt) had never heard of more than ¾ candle being obtained regularly by this means; and ½ candle had been the average, he knew, in one place. Respecting the quantity of gas made per ton of coal, his make in 1896 was 10,300 cubic feet; the tar produced was 15 gallons; the coke made for sale, 9½ cwt.; and the liquor, a little over 30 gallons of 5½° Twaddel. Adding to this the loss of working, they had the 20 cwt. of coal accounted for very well. Mr. Carpenter said that tars produced from the Great Yarmouth gas was very poor in oils. If the enriching effect was dependent upon the light vapours, he certainly thought the less there was, the less the resulting effect. The condenser tar being only about one-eighth of the total made, he considered the analyst was quite right in saying that, from the commercial point of view, there was practically no difference. As to the enriching cost of it, he thought he was generous in allowing 0·15d. Mr. Guyatt had stated simple facts as to what he saw and did when at Grantham. Mr. Prentice had asked a very pertinent question with respect to the testing of the illuminating power of the gas. They used a Letheby open-bar photometer; and these tests were made with Wright's "London" argand and the Methven screen. Naphthalene was a thing they were troubled with at Grantham when he first went there, especially in the small fittings of the houses in the lower part of the town. It had, however, disappeared since the enricher had been at work; and in the first six weeks, they had only one complaint of naphthalene deposit. There had not been any since; and that was more than fifteen months ago. Mr. Barton's remarks as to an accumulation of naphthalene bore out his speculative ideas as to the action of his station meter.

The PRESIDENT observed that the paper opened up the vista of enriching their gas for next to nothing—this was what it really amounted to. The loss of oils in the pitch or tar was more than compensated for by the gains. He proposed that a very hearty vote of thanks be accorded Mr. Shadbolt.

Mr. BARTON seconded the motion, which was unanimously carried.

Mr. SHADBOLT briefly responded.

Mr. BARTON's communication, previously referred to, was as follows:—

AN EXPERIENCE WITH NAPHTHALENE.

With your permission I should like to relate an experience I have had recently with naphthalene—its sudden appearance at the Peterborough Gas-Works, and how it was dealt with. To be troubled with naphthalene at these works was a thing unknown—at any rate, I can speak for the past twelve years from my own knowledge. But about six months ago, it suddenly appeared, and made its presence felt in a very determined manner—why, I am not prepared to say. Its first appearance was at the inlets of three out of four gasholders; then at the centre-valve of the purifiers. An attack of this kind in the positions I have named at the beginning of a winter season was anything but pleasant. The inlets of the three holders were attacked simultaneously; and, as they were in daily requisition, the question arose, how best to deal with the obstructions, and with the greatest expedition. The first idea I had was to employ steam; so I had a pipe fixed to each of the three inlets, and steam applied, which, in the course of two or three days, had the desired effect of removing the obstructions from No. 1 and 2 holders, and we have had no trouble with these since. But upon No. 3 holder the steam had no effect whatever—doubtless because the pipes are larger, and the steam lost its force.

The next course pursued was to seal the syphon of the inlet of this holder, and examine the pipe, which revealed the fact that the obstruction was above the bend in the upright pipe inside the holder. To get at this meant emptying the gas-holder, and taking off the manhole cover over the pipe. This was done; and, on examination, I found (some 18 feet from the top of the pipe) a mass of naphthalene crystals completely filling the pipe, and which proved to be about 6 inches in thickness. To remove this a quantity of benzol was poured down the pipe; but owing to the thickness of the deposit, and being very hard, tools had to be used to break it, and cut it away from the side of the pipe.

After the naphthalene had been removed, and the course proved to be quite clear, the holder was again put into action; but to my astonishment, after a few days' working, the pressure again began to increase, until it got quite as bad as before. We again emptied the holder and made another examination, and found that the naphthalene had formed in precisely the same way and position as before, so we repeated the operation previously described. The holder was then put to work once more; but again, after a short time, the pressure began to show signs of another obstruction, which satisfied me that the remedy already applied was not a permanent cure, and that it was useless proceeding further on these lines.

The question then arose, How was this intolerable nuisance to be stopped? Steam had failed. Cleaning out would not answer for long. What was to be done? I decided to try the benzol in another way, and obtained a cask of this material, and applied it as follows: I had a syphon of ¾-inch wrought iron tube made, and fixed on the inlet main (between the station meter and the holder) in such a position that a small continuous stream of benzol would run into the main, and pass forward with the gas in the holder. I also applied benzol to the Hawkins carburetter (in lieu of tar), by which means the benzol became heated and converted into vapour. This also passed forward with the gas from the inlet of the exhauster; and the two arrangements combined had a wonderful effect. The naphthalene disappeared almost immediately; and I am delighted to say that we have not been troubled with it since. One cask of benzol was sufficient to clear the whole of the mains; but I keep a quantity in stock in case the naphthalene shows signs of re-appearing.

I am not prepared to say to what extent the illuminating power was affected by the application of benzol; but I have no doubt that it benefited by it to some degree. I am satisfied, however, that any one suffering from naphthalene deposit cannot do better than employ benzol in the way I have described, or in some other suitable manner.

Mr. CHESTER said he might mention one other way of getting over the difficulty in connection with naphthalene in the inlet and outlet pipes of holders. That was by putting a barrel of naphtha down the pipes, and then filling up the pipes with water. As the water rose, it would bring the naphtha into contact with the naphthalene, and dissolve it, commencing at the bottom, right up to the top. They merely pumped out the water, and then pumped the naphtha containing the naphthalene back into a cask. The operation was successful, and merely involved the labour in filling and emptying the pipes.

PLACE OF NEXT MEETING.

On the invitation of the PRESIDENT, the members decided that the autumnal meeting should be held at Ipswich.

The Directors of the Peterborough Gas Company were cordially thanked for their co-operation in making the meeting a success; and this concluded the proceedings.

In the evening, the members and several friends dined at the Grand Hotel. The customary toasts were duly honoured; and the enjoyment of the evening was much enhanced by several interesting speeches and popular songs.

North British Association of Gas Managers.—The Secretary of the Association has sent out his usual circular inviting the co-operation of members in the arrangements the Committee are making for the annual meeting in July next, by contributing a paper on some question of general interest to the profession. In the event of no subjects having specially occupied attention, a list of sixteen—covering a wide range in connection with the manufacture and distribution of gas—is given, from which to make a selection; and it is to be hoped that a good presentment of papers will be the result.

Coal Mining in Japan.—According to the Tokio "Economist," coal mining has made remarkable progress in Japan during the past two decades. In 1875, the output was a little over 560,000 tons. In 1893, the supply was upwards of 3,307,000 tons; and those engaged in the business estimate the subsequent output at 10 to 20 per cent. higher. About half of this yield is consumed in the country; the remainder goes to Hong Kong, Shanghai, Chefoo, Newchang, Singapore, and San Francisco. Hong Kong took about 600,000 tons last year for steamers and factories; Cardiff coal at present currency prices finding no market for ordinary use in the East, and the possible rivals of Japan in the future for the supply of the markets—Tonquin and Australia—being as yet of little account. In San Francisco, Japanese coal is employed for generating gas; but the price there forbids its extensive use, and no reduction is probable, since ships that would carry coal to that point would find it very hard indeed to get a return cargo.

* See "JOURNAL," Vol. LIX., p. 393.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle.

The Fortieth Half-Yearly Meeting of the Association was held in the offices of the Newcastle and Gateshead Gas Company last Saturday. There was a large attendance, which was attributable to the fact that the Hon. Secretary and Treasurer —Mr. William Hardie—was to be presented with a testimonial on his retirement from office. Mr. J. H. PENNEY, of South Shields, the President, occupied the chair.

NEW MEMBERS.

The following were admitted to the Association:—

Members.—Mr. T. Waddom, Secretary of the Newcastle and Gateshead Gas Company; Mr. T. Hardie, Assistant-Manager, Redheugh Gas-Works, Newcastle; Mr. G. Keyte, Superintendent, South Shields Gas-Works; and Mr. A. B. Tobey, Scarborough Gas-Works.

Associates.—Mr. Hooper, Wear Fuel-Works, Sunderland; Mr. N. Reid, Elswick Gas-Works; Mr. S. Cox, Sunderland; and Mr. Cooper, coal agent, Selby.

THE ACCOUNTS OF THE ASSOCIATION.

The PRESIDENT moved the adoption of the annual accounts; remarking that financially the Association was in an excellent position, as usual.

Mr. D. TERRACE (Middlesbrough) seconded the motion; and it was adopted.

ADDRESS BY THE PRESIDENT.

The PRESIDENT next delivered the following address:—

Gentlemen,—It was not my intention to have taken up your time with any formal address this morning; but as we are short of our usual complement of papers—there being but one—I have at the last moment put together a few remarks on one or two subjects which are doubtless of present interest to you.

I have, in the first place, to congratulate you on the continued prosperity of our important industry, which is amply shown by the last Parliamentary Returns of gas undertakings, and also by recent applications to Parliament of gas companies for power to raise new capital and to extend their works. There is also the fact that, notwithstanding the introduction of the electric light in many towns, the number of gas consumers continues to increase. At South Shields, for instance, upwards of 500 new consumers were added to the Company's books last year.

I refer with regret to the recent labour aggressions, which have unfortunately been so rife in our midst. Happily they have been amicably settled for the present. Undoubtedly one of the great commercial questions of the day is how best to arrive at a permanent settlement of such disputes. The relations between capital and labour are ever and anon strained and critical—here to-day, and back to-morrow. All pre-conceived notions of the rights of capital and labour are turned topsy-turvy. Labour appears to be fast usurping many of the functions which rightly belong to capital; and the latter is, in many things, taking a second place. Labour must be conciliated and emancipated from the present vicious system of periodical agitation, which knows no ending. The very essence of this system is the perpetual dictatorial re-assertion of so-called rights.

The desire for agitation should cease, and peace and contentment reign supreme. How is this to be brought about? I venture to think that one of the best solutions of the difficulty is the adoption of the profit-sharing system, which has been so successfully applied by that able gas administrator, Mr. George Livesey. I gather from that gentleman's letter to "The Times" in the early part of this year, that "his profit-sharing scheme was launched seven years ago, with the object of attaching the workmen to the Company, of encouraging thrift, and in the hope that capital and labour in this undertaking might be reconciled. The scheme is simply an extension of the principle of the sliding-scale to the employees. It takes the form of a percentage, dependent on the price of gas, on the salaries and wages of all officials and workmen, payable in cash annually. The condition of acceptance is willingness to enter into a contract of service for a period of twelve months. These contracts are eagerly desired, and greatly valued by the men. The bonus percentages during the seven years have been: 5, 5, 3, 4, 6, 6, 7½. The drop in 1892 was caused by a rise in the price of gas; and the jump from 4 per cent. in 1893 to 6 per cent. in 1894, was due to an increase in the percentage rate given on condition that one-half of each man's total bonus should be invested in the Company's ordinary stock—the other half being payable in cash as before. The condition was accepted; and the total amount paid or credited to the profit-sharers in the seven years is £82,000 odd. The number of profit-sharing shareholders is 2500; and the market value of the £40,500 of stock held by them is over £59,000. Consequently, with money on deposit, for which the Directors allow 4 per cent. interest, they are the owners of £85,000; and before the year is out, there is little doubt the figures will be £100,000. During the whole period of seven years, there has not been a single difficulty or any disagreement with the workmen. The work has been done better, and in a more cheerful spirit; and it can safely be said that the Company are better off financially for the £82,000 paid away."

Mr. Livesey has undoubtedly solved the problem successfully; and you have but to follow suit by adapting the system to your own special requirements and circumstances. Mr. Livesey's admirable letter, from which I have just freely quoted, should be read by every gas official and workman. Copies should be scattered broadcast over the land. Once wedded to the system, I do not apprehend that any divorce would ever be found necessary. When workmen find they are sharing in the prosperity of a company, they will naturally be encouraged to put forth every possible effort to make the concern pay. It has been practically applied in other directions; and I have never heard of any failure where it has been adopted. What can be more acceptable than a system of profit-sharing and payment by results? When such large concerns as that of Armstrong, Whitworth, and Co. adopt a profit-sharing system, it is certainly a great encouragement to those who have not yet ventured to take it up.

It is to be regretted that sulphate of ammonia has not resumed a better tone in the market. I observe by an important circular issued on the 17th inst.—a copy of which I presume most of you have received—that there is a plan on foot for makers to join, and give effect to certain practical arrangements for bringing the merits of this valuable fertilizer more directly under the notice of farmers and others. Nitrate of soda seems to have made headway; and sulphate of ammonia has receded, notwithstanding that the latter is said to contain about one-fifth more nitrogen than the former. The circular in question is opportune; and if sufficiently responded to, no doubt the movement will have the effect of bringing the article into increased favour among buyers of chemical manures.*

The rating of gas undertakings is very unsatisfactory, as shown by frequent important appeals. The system employed at present is like ancient mysteries; and therefore little understood. This wants putting on a more satisfactory footing. The law in relation thereto ought to be amended and simplified. What is undoubtedly needed is the employment of a universal method, applicable, if possible, to the exigencies of all cases—plain, straightforward, and above-board. The present method is un-English. Does the fault not partly lie in the way in which the valuer is remunerated? I am far from imputing any unfair motives to the inestimable gentlemen who value for assessment; but if local authorities pay their official valuers by commission, it is safe to say that you will, as a rule, get a maximum assessment. A minimum valuation will be rare. This is but natural; the interests of the valuer and of the local authority retaining him being identical.

The hypothetical tenant is a wonderful creation. He is magnified into a very important personage, and made to bear such a heavy load as would stagger half-a-dozen tangible tenants. If man, in the shape of a real tenant is fearfully and wonderfully made, the hypothetical tenant is more so. This mysterious medium is very elastic, when applied to rating purposes; he can be blown out to a surprising degree. The assessment of a real tenant is often big enough for him to cope with; but it is nothing to that of his more shadowy brother, who is supposed to have no feelings, and to be therefore capable of standing anything. Fewer concerns would be over-rated if there were more appeals made to Quarter Sessions. The majority of appeals are successful. If you demur to an assessment, the Official Valuer usually says: "I am prepared to stand by my valuation in any Court of Law." Ratepayers should not be deterred by such a reply, if they consider they are over-assessed; they should appeal. Doubtless many are deterred from doing so, chiefly in consequence of the trouble and expense involved.

In conclusion, I express the hope that gas undertakings may go on prospering. There is doubtless much in studying and realizing the tendencies of the age, and keeping in touch and in harmony with the public. Whatever the times demand, we should do all in our power to meet. We should give the gas-consuming public every attention, indulgence, convenience, information, and encouragement, even up to the hilt. Non-consumers should have every information, every encouragement, and every facility placed in their way, in order that they may become consumers. There is still a wide field in every town in this direction. I feel sure that you are not only advocates for such a policy as I have attempted to pourtray, but that you are also doers thereof. We are all working in our own particular spheres, struggling for one end—that is, to promote the best interests of our respective companies or local authorities, as the case may be.

TESTING APPARATUS FOR SMALL GAS-WORKS.

Mr. G. SISSON, of the Washington Chemical Works, Durham, then read a paper on the above subject; illustrating his remarks by the aid of some apparatus he had arranged for the purpose. The following are the principal portions of the paper:—

NOTES ON TESTING APPARATUS FOR SMALL GAS-WORKS.

When asked to read a paper or contribute something to the Association, it occurred to me that good might be done by considering whether it is possible to introduce some means of having a better check on the results obtained in small gas-works—both

* See "JOURNAL" last week, p. 892.

as regards the quantity and the purity of the gas produced. A large works is provided with automatic recording instruments for pressure, temperature, and yield; but such appliances are too expensive to use on a small scale, and more than this the necessary skilled supervision is rarely available. At the same time, the village consumer would prefer to have his gas as pure and as cheap as possible; and the shareholders also their dividend.

To obtain a good result in carbonizing, it is well known that heat and pressure are the two prime factors—as regards quantity, high temperature, and low pressure—in the retort-house. Probably even the smallest works is provided with a water pressure gauge, and most of them with an exhauster. But the gauge is not always under the eye of the workman, who has his various duties to perform; so that great variations may happen, and continue for some time, without his being aware of them. Consequently, it was found that an alarm bell is much more efficient, especially as the sound may be made at any distance from the pressure record. A simple apparatus to achieve this is shown here. It is not liable to get out of order, as no liquid is used. This particular one has been working for months; and it admits of being regulated to ring at any desired pressure or vacuum. It is hardly necessary to explain that the bell may be placed at a distance; the wires being led from the box to the bell. The internal arrangements are: (1) A small thin india-rubber bag, with a connecting pipe; (2) a flat piece of wood, with a brass rod. This piece of wood lies on the bag, and when raised by the expansion effects metallic connection of two small dry cells. The arrangement is very sensitive; and the bell continues ringing as long as the abnormal pressure exists. This one is graduated to about 2 inches of water pressure.

Suppose the attention of the charge man is called by the ringing of the bell, on proceeding to the exhauster-house, a glance at the dial and pointer will indicate to him what is wrong. An ordinary governor and bye-pass with throttle valve are employed; but firmly attached to the spindle is a pointer, which indicates exactly on the graduated dial the position of the throttle valve. The pointer at the zero mark, of course, shows that the exhauster is running too slowly; while at 90° mark it would be too fast, as at that point the bye-pass is full open, and this might lead to excessive exhaustion, besides causing waste of steam. The right position is nearer to the zero mark. With a uniform speed of exhauster, the pointer indicates the rate of gas production.

We come now to the question of candle power and purity of the gas as distributed. The requirements here are simple and inexpensive appliances to give the following results: Illuminating power; presence or absence of sulphuretted hydrogen; ammonia; total sulphur. And beyond these, means should exist for testing prepayment or slot meters and regulator burners at various pressures. The apparatus shown has been devised to serve those various purposes.

For the first requirement—that is, testing candle power—we must fall back upon some form of jet photometer, which (if not quite accurate) will give useful comparative results. The form here has the advantages of being very simple and not expensive. By the courtesy of the Newcastle Gas Company and Mr. Pattinson, the one on the table was compared with their standard photometer; and the variation did not exceed ½ candle. To indicate sulphuretted hydrogen, all that is needed is a glass tube containing a piece of paper soaked in acetate of lead solution; also a fragment of red litmus paper, to show ammonia. For the total sulphur we have our old friend the Referees' apparatus, which needs no description.

Discussion.

The PRESIDENT said he was sure that they had had a most practical and excellent paper from Mr. Sisson; and he supposed the members would now discuss it.

Mr. JOSEPH HEPWORTH (Edinburgh) said they had just listened with very much interest to the paper; and he thought that after hearing it every manager, even of the smallest works, might very well desire to have apparatus such as they saw before them—simple as it was, and familiar to most of them—in his own works. The only difficulty he apprehended with it was as to dealing with the quantity of sulphur present in the gas. But apart from this, the whole apparatus was so exceedingly simple, and so well adapted for small works, as Mr. Sisson had told them, that he (Mr. Hepworth) could not conceive of anyone not desiring to have such facilities within his own reach, and in his own hands, for testing the purity of gas, and the other features which had been pointed out to them in the paper. Personally, he wished to express his thanks to Mr. Sisson for bringing so simple and so interesting a matter before the attention of the members of the Association.

Mr. HERBERT LEES (Hexham) said he had listened to Mr. Sisson with interest; and he should be glad to take further opportunity of inspecting some of the apparatus before the meeting. It was not unfamiliar, by any means. As to the meter-testing arrangement shown, he did not quite see where there was any novelty about it, or how it was to test a meter except the ordinary testing of its registration. The difficulties with prepayment meters, so far as there were difficulties with them, were over and above the ordinary meter, and were in regard to the coin arrangement; and he was not aware that any testing apparatus on the table dealt with this. As he had already said, the apparatus before them was familiar to most of them; but, to his mind, the difficulty of its introduction into small works had not been removed. Some of it, of course, could be introduced, and could be worked easily; but one of the greatest obstacles to its introduction would be its cost. There would be not only the cost of what they saw on the table, but also of a balance and other chemical apparatus which would be required to work the tests. These were comparatively easy to procure in works of fair size; but to a small works they would be expensive. There was no doubt that the apparatus might be very generally used if it could be acquired at slight cost. There was no reason, however, why they should not use those parts which were within the means of every company. He thought they were indebted to Mr. Sisson for bringing the subject forward; and if any manager of a small or medium-sized works should be induced to go into the matter, and adopt some of the apparatus shown, or some similar apparatus, perhaps Mr. Sisson would feel that his efforts had not been in vain. They should thank him most if they adopted some of the things he had recommended to them. He was quite sure there were some parts of the apparatus which would be of advantage to them.

Mr. H. TOBEY (Malton) asked Mr. Sisson if he did not find the india-rubber bag very apt to get corroded by the action of crude coal gas upon it. He was afraid that it would very soon come to grief. If Mr. Sisson found that this was not the case, of course that would be an answer to the objection to the use of india-rubber. With regard to some of the other apparatus, of course it was well known to all of them that the Gas-Works Clauses Acts did not require very great refinement in small gas-works. The only stipulation was that they should free their gas from sulphuretted hydrogen, but not ammonia. And this was managed very well by changing the purifiers in time. In most small gas-works, he thought, it would be difficult to find a man who could conduct a test for sulphur compounds or sulphuretted hydrogen. As regarded ammonia, his experience was that the price of it was so very low now that they took no notice whatever of it; they did not wash the gas, or scrub it even, to remove the ammonia. He had, in different towns, found, by a piece of red litmus paper, that the gas was generally strongly impregnated with ammonia. There was no doubt that the purchaser of waste lime found it a valuable product, seeing that it would be very well charged with ammonia. It was most difficult to get those in charge of small works to use sufficient washing and scrubbing to remove the ammonia. He had, at various times, urged upon managers that they should do so, because of the detrimental effect it had upon their meters, and upon the brass-work and fittings in the town generally, which got damaged by the quantity of ammonia that went forward. They were much obliged to Mr. Sisson for bringing the subject forward. Perhaps it was not very novel to some of them; but it was probably well to see how ideas with regard to testing were worked by different persons, who, perhaps, arrived by different methods at the same end.

Mr. E. H. MILLARD (Durham) understood that Mr. Sisson estimated his sulphur compounds volumetrically, and he thought further information on this point might obviate the objection which had been raised as to the requirement of a balance.

Mr. C. D. DRURY (Sunderland) said, with regard to the sulphur-testing apparatus, he thought that in a small works Harcourt's colour-test was quite a sufficient guide. Of course, with the Harcourt test they did not get the absolute amount of sulphur; but it gave a comparative test. Possibly the greatest advantage of Harcourt's test was that any intelligent labourer could use it after a short time. He should think that, in a small works, it was quite sufficient. With regard to electric alarms, at the works he was connected with they had an electric alarum on the main leading to the town, showing the pressure of the gas as it was being supplied to the consumers. The alarum was not worked exactly in the way Mr. Sisson's was. The pressure worked a pointer on a dial, and there were adjustable brass connections made on each side; so that, if the pressure either exceeded, or was less than, the proper amount, the electric connection was made, and the bell rang. The connections were arranged so that they suited whatever pressure might at the time be on the town. They had had an instance of how it worked not very long ago; showing the great advantage of having an apparatus of this sort. Both of their station governors were fitted with cocks at the bottom of the tank, for drawing off the water; and during the winter the frost must have cracked one of them. One day they were startled by the vigorous ringing of the bell, and found that the cock which had been cracked had broken away, and had let the water out of the governor, so that it was fast settling down. The electric connection warned them in time to make up the water and put things right. He therefore thought it was a very useful piece of apparatus to place either on the works or on the district.

Mr. SISSON said the principal point raised by the speakers, so far as he could make out, was as to the estimating of the total sulphur compounds in gas. Regarding the colorimetric process, he might say that the other process which he had in his mind was the volumetric process, of allowing the precipitate to settle, and adding successive quantities of a re-agent, which could be done, and which would, at the same time, give a very fair approximation of the sulphur—requiring no elaborate apparatus and no great amount of skill. With reference to the remarks regarding the value of ammonia, it was a question to which

everyone must apply his own mind, as to the extent to which it would pay to remove the ammonia. At the same time, it was necessary to include it among the tests which were required for gas-works.

Mr. J. H. Cox (Sunderland) moved a vote of thanks to Mr. Sisson for his paper.

The PRESIDENT seconded the motion. He thought they must all be obliged to Mr. Sisson for attending and giving them his paper. Papers seemed to be rather scarce—both members and associates appeared disinclined to come forward with them. He was sure they were all very much indebted, also, to the gentlemen who had fitted up the apparatus shown. Though it was said to be applicable to smaller works, he had no doubt much of it might be made useful in larger works also.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT announced that the following had been elected office-bearers for the ensuing year:—

President.—Mr. J. Holliday, of Scarborough.
Vice-President.—Mr. C. D. Drury, of Sunderland.
Auditor.—Mr. W. B. Davidson, of Tynemouth.
Hon. Secretary and Treasurer.—Mr. J. H. Penney, of South Shields.
Committee.—Mr. W. Hardie, jun., of Tynemouth, and Mr. E. H. Millard, of Durham.

The PRESIDENT intimated that the next meeting of the Association would be held at Scarborough.

Mr. HOLLIDAY expressed his thanks for the honour they had done him in electing him President for the ensuing year. When the idea dawned upon him that such a result was possible, he could assure them that he felt somewhat diffident at the prospect; and when he looked back at the list of gentlemen who had filled the office, his doubts became greater. However, he should do his best to fill the office as worthily as possible; and he could only hope that at the end of the year he might be able to hand over the office to his successor in the same manner as Mr. Penney had.

Mr. LEES proposed a vote of thanks to Mr. Penney for the very able manner in which he had performed the duties of President. They all remembered the excellent meeting they held at South Shields, and the very excellent address Mr. Penney gave them there; and he knew, as a member of the Committee, that no President could have devoted more attention, and been more anxious for the interests of the Association, than Mr. Penney had been.

Mr. T. BOWER (West Hartlepool) seconded the motion. He said they knew that the President had made special efforts to render his year of office a success; and he thought they might, at the close of the year, congratulate themselves upon the selection they made at the beginning.

The motion was adopted.

The PRESIDENT said he was very grateful indeed for the vote of thanks. What he had tried to say to them upon matters of gas administration had been what he thought to be correct, according to his ideas.

PRESENTATION TO MR. W. HARDIE.

The members and their friends afterwards dined together in the County Hotel—Mr. PENNEY presiding.

The PRESIDENT, in the course of the toast-list, said it was his especial privilege—and it was also a very great pleasure to him—to present to Mr. Hardie, on behalf of the subscribers, those tokens of their respect and esteem, and of their appreciation of his long services in connection with the Association, which they saw before them. Since the formation of the Association, there was no doubt that Mr. Hardie had been the pilot who had kept them right, and who had steered them from the beginning to the present time. The Association was successful at the beginning; and it was to-day as successful as it was then. He must thank those members, associates, and friends who had so readily and so handsomely responded in the matter of the testimonial to Mr. Hardie. He at the same time had pleasure in referring to the many very kind letters which had been received on the occasion, all indicative of the highest esteem for Mr. Hardie, and expressing most kindly sentiments regarding him. They could all endorse and emphasize these kindly feelings and sentiments. Mr. Hardie had indeed been a secretary of secretaries—he might say a king of secretaries. No praise, he thought, could be at all too flattering of him. The letters formed, in his opinion, a chain of evidence, if such were needed, that Mr. Hardie had indeed been to the Association more than perhaps he (the President) could express in his feeble language. Nothing could, in his opinion, be said that would fully meet the position their Secretary had maintained all through. He formally asked his dear friend Mr. Hardie to receive at his hands these kindly gifts which would show to him the high appreciation in which he had been held all along by the members and associates. He hoped that, though not of very high intrinsic value, they would speak to him, and would show him that the feelings of his friends in connection with the Association had been of the highest and most cordial description. They trusted that his future might be one of extreme happiness and comfort. Mr. Hardie had now retired from his profession; and they trusted that the leisure he had obtained would be the means of enabling him to establish his health, and that he would not regret having given himself the necessary rest for the purpose.

The presentation consisted of a silver coffee service, a silver hot-water jug and cake-basket, a case of silver dessert knives and forks, and a Parisian timepiece and pair of vases. On the coffee-pot there was the following inscription: "Presented, with other gifts, to Wm. Hardie, Esq., Newcastle-on-Tyne, by the Members and Associates of the North of England Gas Managers' Association, in recognition of his valuable services as Honorary Secretary and Treasurer for twenty years. April 24th, 1897."

The PRESIDENT (continuing) said they would hardly expect a long reply from Mr. Hardie, for he was in but feeble health; but before their friend responded, he would ask Mr. Sellers to say something on the subject.

Mr. CHARLES SELLERS (York) said the call which had been made upon him was, he could assure them, a task which he could very ill discharge. He had come there that day to mingle his sincere regret with, he ventured to say, the regret of everyone there, at the necessity which had arisen for his friend Mr. Hardie to retire officially from the Association as well as from the Company he had so long and so faithfully served with the very best years of his manhood. To contemplate the Association without the name of Mr. Hardie as their Secretary and guiding spirit, was very much, in his judgment, like contemplating the play of Hamlet with the part of Hamlet left out. Mr. Hardie had been connected with the Association from its very birth. During its early years he was practically the wet-nurse of the Association; and under his judgment, tact, and skill, the Association had grown to a manhood that was perhaps second to no other similar organization in the kingdom. Some men were born to honour; and some had honour thrust upon them. But Mr. Hardie had achieved honour by his whole conduct, his whole life, and his whole industry.

Mr. J. HEPWORTH (Edinburgh) said that this was one of those occasions when it was a greater honour to be allowed to take part in the proceedings than it was a pleasure; for, whatever pleasure there was in being there that day—and he was sure everyone had sincere and hearty pleasure in being present—the pleasure was mixed with a feeling of regret which one could not quite suppress. In the absence of Mr. Warner, the first President of the Association, he was permitted, as the second President, to add a word to the more eloquent expressions of their feelings which had been given by the President and Mr. Sellers. Through his very intimate acquaintance with the formation of the Association, he could corroborate what Mr. Sellers had said; for, had it not been for Mr. Hardie's efforts at the time the Association was projected, they could not have succeeded in forming it, much less in carrying it on so successfully as it had been these twenty years. It was to Mr. Hardie more than to any other man that they owed the success of the North of England Gas Managers' Association. There was something pathetic in seeing the warrior taking off his armour; and this was what they were asked to look upon that day. But he trusted that Mr. Hardie would be preserved for many years to enjoy the pleasures of a quiet and unharassed life, and that he might enjoy the pleasures which his own tastes had led him to—literary to a large extent, he believed—and that in these pleasures he would find ample occupation for the remainder of his years, which he hoped would be many.

Mr. HARDIE said he thanked the President for his very kind remarks in presenting to him the testimonial, which he had very great pleasure in accepting as a memorial of his connection with the Association. He had also to thank Mr. Sellers and Mr. Hepworth for their appreciative references to him and to his work. He also begged to thank the members of the Association for their kindness in presenting him with so valuable a testimonial. In accepting it, he should like to say that, during all the years he had been Secretary, he had had to depend greatly upon the Committees who were appointed; and to these Committees, embracing a great many members of the Association, he had to tender his grateful thanks for the assistance they had given him in all that had been done for the Association. He hoped they would kindly remember the services of those who had helped him. He could only again return them his most grateful thanks.

The proceedings terminated with the National Anthem.

Huddersfield Corporation Water-Works.—It was reported at last Wednesday's meeting of the Huddersfield Town Council, that the surplus profit from the water-works for the financial year just closed had been £7168, of which it was proposed to carry £5000 to the depreciation account. The balance of £2168 has been placed to the reduction of the borough rate.

The Crystal Palace District Gas Company and the Beckenham Council.—At the last meeting of the Beckenham District Council, the Clerk reported the result of the appeal of the Crystal Palace District Gas Company against the decision of the Bromley Magistrates on the question of the quality of the Company's gas. The appeal, as reported in the "JOURNAL" for the 13th inst., was dismissed. A point of law had now, he said, been raised as to the exclusion of certain evidence, which the Court of Quarter Sessions refused to admit; the evidence in question being that of officials from other districts. He did not consider there was a great deal in this; and if the High Court sent the case back to the Justices, it would not, he thought, avail the Company much. He went on to say that some additional evidence was discovered after the notice of appeal was given; and, in view of this, there was no wonder that a difference should be found between the Company's experts and the Council's witnesses.

REGISTER OF PATENTS.

Production and Storage of Acetylene Gas.—Clausolles, E., of Barcelona. No. 11,737; May 29, 1896. Date claimed under International Convention, Jan. 24, 1896.

This apparatus for the production and storage of acetylene gas for illuminating purposes mainly consists of two receivers one above the other; the upper part serving to contain water, and the lower to contain carburet of calcium. The receivers communicate with each other by a tube fitted with a cock or valve, which may be opened or closed according as the bell or dome of a gasholder descends or ascends—the gas generated being stored in the holder. Other accessory arrangements for facilitating the operation of the plant, as well as for its preservation and safety, are described in the specification.

Production of Illuminating Gas.—Lewes, V. B., of Greenwich. No. 6922; March 30, 1896.

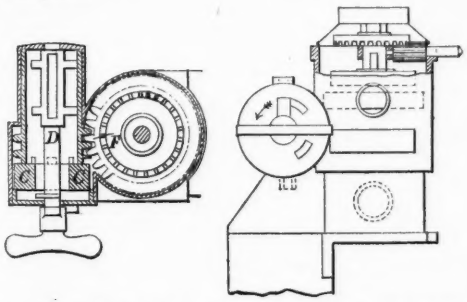
This invention relates to "the manufacture or production of illuminating gas by subjecting to the action of water a mixture or combination of metallic carbides decomposable by water with liberation of a gaseous mixture containing acetylene and other hydrocarbon gases." The specification (which is not illustrated) states: "As is well known, when lime and carbon are fused together in an electric furnace, calcium carbide is produced; and, on decomposing this compound by adding to it water, lime is left behind and acetylene gas escapes. Acetylene gas so produced has a high illuminating power, but is so rich in carbon that difficulty has been experienced in burning it by itself, owing to a tendency which the flame has to smoke when the gas is consumed in ordinary burners; while another objection is that the light is too intense for ordinary domestic illumination. With a view of obviating or mitigating this difficulty, it has been proposed to mix the gas with air; but, owing to the very wide range over which mixtures of acetylene and air are explosive, this is a highly dangerous practice. In order to avoid this danger, it has been proposed to dilute the acetylene with other gases—such as nitrogen, hydrogen, carbon monoxide, &c.—but most of these cause considerable loss in the illuminating power given by the acetylene, while the production of such diluting gases would give rise to a considerable amount of trouble, and would practically nullify to a large extent the advantages to be attained by the use of acetylene for the lighting of country houses, railway carriages, tramcars, and so forth, where it would be practically as troublesome to have to produce the diluting gas as to manufacture coal gas."

To obviate or mitigate these disadvantages, the patentee proposes to manufacture mixed carbides in an electric furnace, using such compounds in their production as will by double decomposition give rise to a high temperature, whereby the resulting carbides are produced with less expenditure of electric energy than heretofore. In the manufacture of the mixed carbides, such metals are chosen that the carbides formed can be decomposed by the action of water, with liberation of not merely pure acetylene but of a mixture of acetylene and other hydrocarbon gases and hydrogen, or of acetylene and other hydrocarbon gases that can advantageously be utilized for illuminating purposes.

The invention can be carried out in various ways. For example, a mixture of peroxide of manganese, lime, and excess of powdered charcoal or other finely-divided form of carbon—say, by weight, 261 parts of peroxide of manganese, 56 parts of lime, and 72 parts of carbon—are heated in an electric furnace in the ordinary way. Oxygen is liberated from the manganese, which at once sets up violent combustion with some of the carbon present; the heat of combustion, together with the heat of the electric arc, determining the combination of the manganese and calcium present with the carbon. Oxides of carbon escape; and a fused mass of the mixed or combined carbides of calcium and manganese remains. On treating this mass with water, the calcic carbide decomposes, with evolution of acetylene; while the carbide of manganese decomposes, chiefly with the production of methane and hydrogen. The evolved gas consists of acetylene, diluted with methane and hydrogen to such an extent that it can be burnt without smoking.

Prepayment Gas-Meters.—Hawkyard, J., and Braddock, J., of Oldham. No. 6985; March 31, 1896.

This invention relates to a coin-receiver to actuate and form part of an apparatus to be applied to an ordinary wet or dry gas-meter, for the purpose of supplying a definite amount of gas on prepayment by a corresponding coin.



The essential parts of the device (a front elevation and plan of which are shown) consist of an outer cylinder or casing fixed upon the ordinary framework of the automatic apparatus, preferably in a horizontal position. One end of the cylinder may be "cast-in;" and on the upper and lower surfaces and near the "cast-in" end are two slots—one almost, but not immediately, opposite the other, and both running in a longitudinal direction. The size of the slots is sufficient for the free insertion of a penny or other coin. Inside and revolving in the cylinder is a second cylinder of the same outer diameter as a penny or other coin, having both ends open, and also two longitudinal slots directly opposite to each other at or near to one end, and somewhat wider than the two slots in the first-named cylinder. At the opposite end is a worm F (or it may be a spur-wheel) in gear with a first-motion wheel of the apparatus which opens the gas-valve, and also suitable notches and ratchet-shaped teeth for the purpose of securing, and of preventing the backward rotation of, the inner cylinder. Abutting against the end of this inner cylinder is a weight C, having on one side a tooth to gear or lock with the notches and teeth on the end of the inner cylinder; while on its opposite side are two projections which slide in vertical grooves in the detachable end of the outer cylinder.

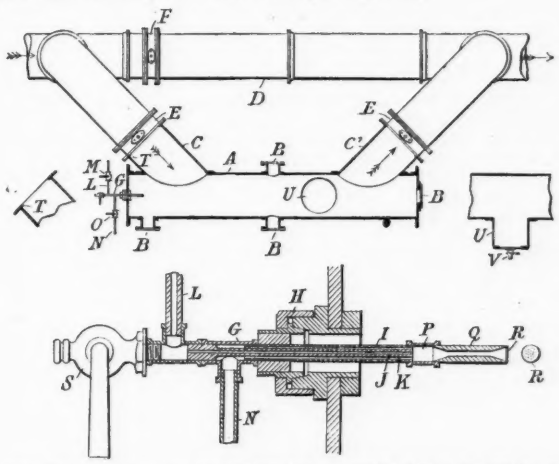
Passing through holes in the centre of the two ends of the outer cylinder is a spindle or shaft D, capable of an oscillating motion, the extent of which is regulated by a handle and two stops on the outside of the detachable end of the outer cylinder—the handle being fixed on the projecting end of the shaft D. On this spindle, and immediately under the slots, is another cylinder or a rotatable coin-carrier, so formed that it can just conveniently revolve without touching the inside of the second cylinder, and having a slot right through it of such size and in such position that a coin, on being put through the upper slot of the outer cylinder, can just pass through the slots of the second cylinder and carrier, and thus lock the two together. The slot in the carrier is so formed at the lower part that (say) a penny cannot slip through the slot while passing round in the direction of the arrow to work the inner cylinder; but if it be attempted to work the apparatus with a coin of less value, it will drop from the carrier and through the slots without working the cylinder, as the slots in the cylinder are broad enough to allow of this action. The inner cylinder cannot therefore be reached when the apparatus is at rest, and so moved by a knife or other instrument without a coin.

Producing and Storing Acetylene.—Trouvé, G., of Paris. No. 23,591; Oct. 23, 1896. Date claimed under International Convention, April 14, 1896.

This invention relates to improvements in the apparatus described in patent No. 23,521 of 1895, and which was principally characterized by the combination of one or more generators (capable of being easily charged, repaired, and cleaned) with a holder of suitable capacity for the storage of the gas. According to the present improvements, the generator is constructed entirely of metal; the stopper for closing the mouth of the bell chamber being dispensed with, while the cage for containing the layers of crystals of calcium carbide is supported upon a stand in the required position, instead of being suspended.

Treating Gas to Prevent Naphthalene Deposits and to Increase its Illuminating Power.—Botley, C. E. & C. F., of Hastings. No. 9316; May 2, 1896.

The patentees say they find that "to effectually prevent the formation of naphthalene and like deposits, and to absorb or dissolve any deposits which may exist, it is necessary to saturate the gas with an oil or liquid hydrocarbon in the form of a very fine mist—light enough to be readily suspended and carried by the gas." This is effected by passing the gas to be treated through a vessel, at one end of which is one or more specially constructed "atomizers" for producing the hydrocarbon mist, so that the gas will thus carry a certain amount of oil in mechanical suspension. The degree of saturation would vary according to the specific gravity of the gas—that is to say, in cold weather more oil is used than in warm weather. It is essential to the proper working of the process that the gas shall be treated with the atomized oil at a temperature as near as possible to that of the gas in the mains, and that the apparatus shall be so formed as to render the working of the atomizer visible; also that the oil shall be thoroughly strained before it is used. Any suitably liquid hydrocarbon, from 650 to 980 specific gravity, may be used; but the patentees have obtained excellent results from American lamp oil of 790 to 810 specific gravity.



The illustration shows the carburator connected with a gas-main, and the position of the atomizer. A cylindrical metallic vessel A is provided having glass-covered windows B through which the interior can be inspected, and also inlet and outlet branches C C^1, connecting with the main D. Each branch is provided with a valve E, so that communication between the vessel A and the main can be shut off when desired, in which case the bye-pass valve F is opened. But when the apparatus is in use, the valve F is closed; and the valves E are open. The atomizer G is arranged at the end of A nearest the inlet-branch C. It is attached to the vessel by a coupling H and suitable fittings. It is composed of the tubular body I, within which the tube J is suspended in order to form an annular space K between the tube and the body I. An oil-supply pipe L, fitted with a regulating-cock M, connects with the body, and communicates with the interior of the tube J. The pipe N for the supply of pressure is provided with a regulating-cock O. It also connects with the body I, but communicates with the annular space K. An expansion

chamber P (in which the oil and pressure combine) is formed at the extremity of the tube J, and connects with the nozzle Q, having a perforated striking-plate R at its outer end, to complete the atomization of the liquid. A cock S is attached to the end of the tubular body I, in order that the tube J may be cleared of any foreign matter, should such an operation be necessary. A small flange T projects into the branches C C¹, to prevent over-saturation of the gas, and also to prevent any liquid oil from entering the mains. A well U, provided with a draw-off tap V, is formed in the lower portion of A, to receive the drip from the atomizer and any superfluous oil in the vessel.

The patentees claim as their invention: 1. The particular process and apparatus in connection therewith, for the treatment of gas for illuminating and other purposes. 2. In the treatment of gas for illuminating and other purposes, the combination with a vessel such as A of an atomizer G, composed of the tubular body I in which the tube J is suspended to form the annular space K; the supply-pipes L and N connected with the body and fitted with regulating-cocks; and the expansion chamber P and nozzle Q, provided with a striking-plate R, with or without the clearance cock S, and suitable coupling for attachment to the vessel A.

Producing and Utilizing Acetylene Gas.—Trouvé, G., of Paris. No. 23,592; Oct. 23, 1896. Date claimed under International Convention, May 11, 1896.

This invention also relates to improvements in the apparatus described in patent No. 23,521 of 1895. The improvements consist: Firstly, in a novel arrangement of condenser for collecting the aqueous vapours carried along with the gas, and for cooling the gas to a certain extent; Secondly, in the application to the generator of a syphon for preventing the escape into the atmosphere of the gas generated in excess. The claim made for the invention is in these terms: "In a combined generator and lamp for producing and utilizing acetylene gas for lighting purposes, the combination of the receiver, supporting a condenser filled with beads or porous material in a divided condition and a safety syphon with a cage for containing the carbide, supported by a frame at the proper height within the receiver, into which it is introduced from the bottom."

Flushing Cisterns.—Price, F., of Weston-super-Mare. No. 12,324; June 5, 1896.

This invention relates to syphon cisterns used for flushing water closets, lavatories, and the like; and it has for its objects: Firstly, to provide means whereby more than one flush or portion of its contents may be syphoned off from one filling of the cistern. Secondly, to provide means whereby the quantity of each flush may be determinable, adjustable, and equal, or approximately so. Thirdly, that when a second flush is desired, this may be obtained without having to wait the length of time usual in flushing cisterns, and this without unnecessary waste of water.

Fig. 1.

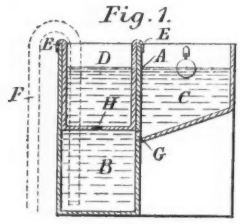
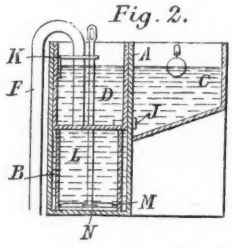


Fig. 2.



The tank or container is preferably rectangular in plan, and divided longitudinally by a water-tight partition A (fig. 1) in such a manner that the compartment B is twice the depth, or thereabouts, of the compartment C. This supply chamber is provided with a ballcock or other automatic valve, and connected to the water supply in the usual way. In the larger compartment B (the flushing chamber) is a solid or hollow block of wood or other suitable material, or a metallic or other tank D (preferably the latter), suspended by hooks E upon the upper edge of B, so that D may dip half-way, or thereabouts, into B, and occupy preferably the whole width of same and so much of its length as may be desirable. A space is left between one end of this and the end of B, to permit the presence of a syphon F, the shorter end of which dips into, and reaches nearly to the bottom of, B in the usual way. The syphon is in fixed connection with the block or tank D; and in any suitable part of the lower portion of the supply chamber C, is a small hole or aperture G, through which the water entering C may percolate into the flushing chamber B.

In the tank D is a small hole, preferably of about the same dimensions as the hole G in C, and either open to the supply chamber C or the flushing chamber B. For preference, the hole is in the bottom of the tank D open to the flushing chamber B, so that, as the water rises in the chamber B, it would enter the tank D through H, and rise in D until level with the water in C. In lieu of the hole G in C, a hole may be made in C, and a corresponding hole in D—the two being connected by a hollow cylindrical bush J, as shown in fig. 2, so that the supply chamber C would first partly fill the tank D, and the water percolating from this through the hole H would fill the flushing chamber B.

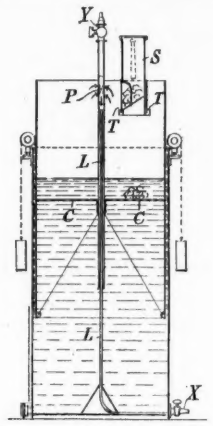
Whatever means are employed for operating the syphon F (the passage in the syphon being three times or more larger than the holes G or H), it follows that, when the syphon is started, this would empty the flushing chamber B before any appreciable quantity of water could enter from either C or D. Therefore the flush could not consist of a much greater quantity than that contained in B. Upon the emptying of B, the water in D and C would continue to flow into B until the latter was again filled. D and C would then be presumably each about half full; and upon the next syphoning off of the contents of B, the contents of D and C would again flow into and recharge B. By this means, three distinct and approximately equal flushes are obtained, which are the first and second purposes of the invention.

Again, supposing that the supply to the chamber C is constant, and that it is recharged as fast as emptied, the flushing chamber B directly it is emptied would commence to refill from the water running into it from D or C or both; so that if a second flush is wanted quickly, the chamber B would be filled considerably quicker than would the chamber C. This is the third object of the invention.

In fig. 2 is illustrated a modification of the arrangement; the material difference being that the syphon, instead of being fixed upon the end of the tank D, is fixed at or about the centre of its length, by means of a bracket K. The inner or shorter end of the syphon passes through the bottom of D, and either terminates as shown, or extends any desired distance below it. According to this arrangement, it is preferred to employ the hollow bush J, passing through a hole in both C and D, so that the feed of B may be from the tank D, and this from the supply chamber C, as shown.

Generating and Storing Acetylene.—Gibbs, R. R., of Egremont, Cheshire. No. 12,788; June 10, 1896.

This invention is designed to obviate certain of the disadvantages experienced in the working of many of the present forms of acetylene generating apparatus—the claims advanced by the patentee being for the application of oil for keeping the carbide free from damp, for charging the apparatus without material loss of acetylene, and for "the general arrangement and construction of a generating device with removable diaphragm and struts, taken as a whole, substantially as illustrated.



The apparatus consists of a tank and counterbalanced gasholder, with a central pipe L rising from the cock X up the centre of the base of the tank, and with a pipe surrounding it and acting as a guide; also for the acetylene to escape by through holes P. The object of these two pipes is to enable the gas to be drawn off either through the cock X or cock Y, without either the water or the petroleum floating thereon being drawn off with it. The tank is filled with water to any convenient height; and above the water a thick layer of oil is poured. The holder has a diaphragm C in it; and at the top it is supplied with a feeding-device S. This consists of a chamber into which the carbide is filled, and which slides within a vertical tube which forms part of the holder. The lid of the chamber S is then fixed in place; and the chamber being lowered, the carbide slides off the slanting bottom through the side opening in S. The chamber is then drawn up until its mercurial seal T immerses the bottom of the tube, and is held in position by the swivel-catch shown by dotted lines.

Production of Acetylene.—Gastine, G. S. T., of Marseilles. No. 20,529; Sept. 16, 1896.

This invention relating to the automatic production of acetylene, refers to apparatus comprising two distinct parts, which can be in juxtaposition in a single apparatus, or separated one from the other vertically or horizontally. Two pipes connect the parts; and it is through the medium of the gas which passes through them, that the two parts of the apparatus react on one another to produce automatic working. One of the parts is formed by the gas generators to the number of two or more—identical and working alternatively or successively. The other part is a regulator, which reacts automatically on the generator in work, so as to moderate the production of gas, and render it equal to the consumption, notwithstanding any variations. The arrangement is not further described by the patentee apart from his four sheets of drawings, needing eleven pages of printed specification for their elucidation.

APPLICATIONS FOR LETTERS PATENT.

9294.—Barthez, A. H., "Production of acetylene gas for lighting purposes." April 12.

9345.—Forrett, A., "An incandescent furnace for heating gas-retorts." April 13.

9398.—Baker, H. C., "Gas-engines." April 13.

9440.—Etchells, J. C., "Gas and oil engines." April 13.

9460.—Renault, L., "Gas-engines." April 13.

9488.—Bennett, T. J., and Thomas, W. F., "Gas and oil engines." April 14.

9609.—Simpson, B. G., "Wind guards for protecting exposed gas-jets." April 15.

9714.—Kesselring, U., "Manufacture of acetylene gas." April 15.

9719.—Lebeau, J., "Acetylene gas burner." April 15.

9727.—Gloyne, R. M., "Anti-vibration spring for use in street lighting by incandescent gas systems." April 17.

9762.—Kitchen, J. G. A., "Burners for acetylene." April 17.

9763.—Kitchen, J. G. A., "Producing acetylene from calcium carbide." April 17.

9770.—Walsh, J., "Improvements in gas lighting and in electric lighting for magnifying purposes, and the application of same to lighting in general." April 17.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Position of Sulphate of Ammonia.

SIR,—The proposal put forward by a Committee of the Sulphate of Ammonia Association in their circular of the 17th inst. (given in the "JOURNAL" last week), to form a similar body to the Permanent Nitrate Committee, and to imitate the policy this latter body has employed to assist the sale of nitrate of soda on behalf of sulphate of ammonia, is plausible enough at first sight, and may contain germs of a movement for permanently improving the condition of sulphate. Still, it must be borne in mind that every attempt to "bull" the price of sulphate has for years ended disastrously to those who put faith in it; and those who have frankly met the position, and prepared themselves to face low prices, have fared best. Whether it is worth while on the part of manufacturers to go to expense or trouble in cultivating a local sale, depends a good deal on the consideration given by producers of ammoniacal liquor. In the writer's district there are two or three manufacturers of sulphate, two or three other manufacturers of artificial manures, and a corporation gas manager, working up his own liquor, who is the largest producer of sulphate. The last named sells direct to local consumers and customers of the artificial manure makers at the wholesale price (the same as to brokers), in small lots. Now, is this likely to encourage the artificial manure makers to urge their clients to use sulphate, or to mix it in those manures in which sulphate and nitrate are interchangeable? If the manager would sell sulphate at even less than the wholesale market price to the manure makers, so as to get it into use, it would be more sensible.

It is very easy to sell large quantities of sulphate through brokers, but it requires much cultivation to get together a very moderate connection among local consumers; and when the fair margin of difference between the local price and the broker's price is destroyed, what is to make it worth while to go to the labour and expense of travelling, distributing pamphlets, offering prizes to agricultural societies, &c.? Again, will the manufacturers of sulphate care to pay money out of pocket to raise the price of sulphate, feeling that, when the advance is gained, gas companies will rush in to manufacture their own sulphate, and that blast-furnace and coke-oven proprietors will put down plant to recover products, without consideration whether or not the market will stand the increase? The wisest course at present, in my opinion, is to avoid high-priced contracts in either tar or gas liquor, and leave sulphate, at between £6 and £7 per ton, in all probability in the near future, to make its way on its own intrinsic merits.

April 23, 1897. NH_3.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS COMMITTEE.

Tuesday, March 30.

(*Before Mr.* J. A. CAMPBELL, *Chairman, Mr.* BAIRD, *Mr.* LOUGH, *and Mr.* COLVILLE.)

NEWARK WATER BILL.

This Bill, which is to extend the limits of the supply of water by the Newark Corporation, by the addition to the existing area of 27 parishes, covering nearly 90 square miles, and to enable them to construct works and raise more money, came before the Committee to-day.

Mr. BALFOUR BROWNE, Q.C., Mr. LLOYD, and Mr. HUGH HOLE appeared for the promoters. The principal petitioners against the Bill were the Nottingham Corporation, who have a measure of their own which deals with the supply of two of the parishes proposed to be taken in by the Newark Corporation, and who object generally to the scheme embodied in their Bill. They were represented by Mr. POPE, Q.C., Mr. PEMBROKE STEPHENS, Q.C., Mr. H. Y. STANGER, Q.C., and Mr. HAROLD SANDS. There were six other petitioners against the Bill, for whom the following Counsel appeared: Mr. ERSKINE POLLOCK, Q.C., for the Nottinghamshire County Council; Mr. SHIRESS-WILL, Q.C., for the Corporation of Mansfield; Mr. READER HARRIS, Q.C., for the Southwell Rural District Council; Mr. TOLLER, for the Sutton-in-Ashfield Urban District Council; Mr. WORSLEY TAYLOR, Q.C., and Mr. STATHAM, for the Duke of Newcastle; Mr. FREEMAN, Q.C., and Mr. RICKARDS, for Lord Savile.

Mr. BALFOUR BROWNE, in opening the case, said he thought the Committee would find it absolutely necessary, in considering the merits of the Newark Bill, to take notice of the next Bill in the group—that promoted by the Nottingham Corporation, which was a Bill to empower them to add to their sources of supply from certain wells close to the existing district of the Newark Corporation. He would try, however, to keep the two Bills as separate as he could. The Newark Corporation were authorized in the year 1891 to purchase the water-works of the then existing Company, and also to construct for themselves works for the supply of water to the town and a large district contiguous to it. At the time the Corporation acquired the undertaking, the Company drew water from the River Trent; but the river became largely polluted, and a new and pure source of supply was absolutely necessary. Parliament passed the Bill for the purchase of the works and the construction of others, consisting of a pumping-station and a well at Farnsfield, not only to meet the demands of Newark, but to supply a piece of country lying between Farnsfield and Newark. By the Bill now before the Committee, the Corporation sought to protect the water in the well at Farnsfield; for on the well they had spent £60,000 for the supply of water to a not very large, but important population, numbering, he thought, about 16,000, exclusive of the outlying districts. Newark did not wish to have this money thrown away; and what the Corporation sought to do was to put an embargo upon any person sinking wells within a certain distance of the Farnsfield well. There might be a hardship in this, because some other local authorities might say: "If we are to be prevented from pumping, where are we to get water?" The Bill, however, provided that under these circumstances the Corporation were going to supply the people from the well at Farnsfield; they did not propose to make any new ones. There had been attempts on the part of the various bodies to take the water. It was proposed by the Nottingham Corporation to abstract the water to the extent of three or four million gallons a day. The underground reservoir from which the water would be pumped was not inexhaustible—in fact, it was being rapidly exhausted. There were a large number of pumping-stations in the area, three of them belonging to Nottingham; and the effect of all this pumping had been to desiccate the district. Notwithstanding this, Nottingham proposed to construct a pumping-station at Oxton and Woodborough, the effect of which would be most disastrous to the whole district. Last year, the Nottingham Corporation applied to the Local Government Board for power to extend their limits of supply so as to include the districts of Oxton and Epperstone. Their object, it was candidly admitted, was to extract water from the pebble beds by means of two wells—one at Oxton, and the other at Woodborough. The result of the inquiry by the Board's Inspectors was that the Board refused to grant a Provisional Order; but, notwithstanding this, the Corporation had brought in a Bill and asked Parliament to allow them to make these two pumping-stations, which would, he did not hesitate to say, very seriously injure the district. There was not water enough for them all; and if the Oxton well was sunk, the Corporation would take away that which Parliament had said ought to go to Newark. In order that Nottingham might not pump either at Oxton or at Woodborough, Newark asked the Committee to reject the Corporation's Bill. The Corporation said that if they purchased a piece of land they could sink a well; and as there was no right to underground water, they had a common-law right to take the Newark water at Farnsfield. But Newark replied that they had a superior right to the water, in order to obtain which they had, as he had stated, spent £60,000. He thought the intention of Parliament was that Newark should get this water; and therefore he asked the Committee to say that Nottingham should not come and pump it, and that nobody should do so for the purpose of making a profit. He was not going to limit the right of any owner to obtain water for his tenants; but he said that no large body or company should be allowed to sink a well in the district, and take away the water which Parliament had given to Newark. Therefore, he not only asked the Committee to reject the Bill of the Nottingham Corporation, but to give Newark a clause which would prevent any person sinking wells to get water for the purposes of sale. It was not intended by the Bill that Newark should not sink any other well except the one at Farnsfield. Indeed, the Corporation proposed to make it obligatory upon themselves to supply the parishes prevented from getting water, and to do so from the Farnsfield well only. The learned Counsel proceeded to contend that the action of Nottingham was unreasonable. They were already, he said, pumping largely at Papplewick, Bestwood, and Basford; and the Committee would hear that, if they established pumping-stations at Oxton and Woodborough, they would be pumping against themselves, and moreover it would be only a temporary measure. Within easy reach of Nottingham, there was an abundant supply of water. If the Corporation would go to the upper reaches of the Derwent, and bring the water from there, Newark would allow them to supply the parishes they both claimed. Newark was not seeking for water, but endeavouring to stop the marauding tendencies of Mansfield, Sutton-in-Ashfield, and Nottingham. In conclusion, the learned Counsel dealt with the petitions against the Bill, replying to the various objections raised in them.

The following evidence was then given:—

Mr. *H. Rofe*, examined by Mr. LLOYD, stated that in 1891 the Corporation of Newark obtained an Act for the supply of water to the town, and to certain parishes in the Southwell Rural District Council's district. The pebble bed from which the water was proposed to be drawn by Nottingham, and from which Newark drew its water, had an area of 31 square miles. It was not now saturated with water as it once was, because it had been depleted by pumping operations. Witness produced a diagram showing the rainfall for each year from 1860 to 1896. During the last five years, the average had been 87·7 per cent.; and the mean of the five driest years—viz., from 1861 to 1865—was 86·6 per cent. The mean of the last three years was 91 per cent.; and of the three driest years, 84 per cent. The natural drainage area was 11,710 acres. Witness was examined with a view to showing that the underground stores of water had been gradually reduced by the excessive pumping. Taking the rainfall at 26 inches on the area, and deducting 16 inches for evaporation, 10 inches remained for percolation to the underground reservoir. The quantity of water falling on this area gave rather less than the pumping-stations in the area were taking out. The consequence was that the water was being lowered. This was shown by the fact that the stream of the Dover Beck was now dry for three miles. The levels of the water at the Bestwood and Papplewick wells had very materially lowered; and it was shown at the Local Government Board inquiry last year that the level of the Hucknall well had been decreased. If the proposed pumping from the subterranean reservoir were sanctioned, it would simply be a question of the biggest purse and the biggest pump. It was shown at the inquiry that the Oxton well would affect the one at Farnsfield. He could state that the sinking of the well at Oxton must inevitably mean decreasing the quantity of water in the Farnsfield well; but about the well at Woodborough he was not so sure.

Wednesday, March 31.

Mr. *Rofe*, in further examination this morning, dealt with the petition of the Southwell Rural District Council. He said Newark was prepared to supply with water the districts included in the proposed area, in accordance with charges authorized by the Act of 1891. Local authorities had powers under the Public Health Act to construct works if the Newark Corporation did not, after three months' notice, supply the water. With regard to the petition of the Sutton-in-Ashfield District Council, who stated that they had spent nearly £23,000 on their water supply, and a further sum of £2000 in acquiring a site for a pumping-station at Blidworth, witness said that Sutton-in-Ashfield was a long way outside their own district, and within 1½ miles of the proposed well at Oxton. They supplied a large area for profit. With respect to the contention that the proposals of Newark would have the effect of shutting out the source of the supply to Sutton-in-Ashfield, and so hamper them in fulfilling their obligations, witness said that the Sutton district was a very limited one, and if they were hampered at all it was because they had chosen to incur

liabilities they were unable to fulfil. With regard to the statement that there was no public necessity for including in the Newark limits of supply the parishes suggested, witness said that someone must supply them, and if Nottingham was not allowed to do so Newark must. As to Lord Savile's petition, Newark did not propose to interfere with the parishes of Rufford, Bilsthorpe, and Eakring; they proposed to protect them. Unless these parishes were included in the Newark limits, there was nothing to prevent a marauding body buying a piece of land, under the Public Health Act, and, whether Newark wished it or whether they did not, taking water from the land. The petition of the Mansfield Corporation stated that there was a population of 18,000 in the town, and that their water undertaking cost £62,000. The limits of supply were defined under an Act obtained in 1891, and were confined to the borough of Mansfield. They were now, however, supplying to other districts large quantities of water by agreement. If Mansfield were content to abide at home, they had ample water for all time. The petition of the Mansfield Corporation also objected to the wide extension of the Newark limits; but there was no reason why Mansfield should have the water in preference to Newark. By the proposals of the Bill, Newark was not able to deprive Mansfield of water any more than it was at present. With regard to the petition of the Nottinghamshire County Council, which objected to the Bill unless there was a clear intention on the part of the promoters to supply the district in question, witness said there was such an intention. As to the contention that the proposals of the Bill constituted an interference with the rights of landowners, the County Council were not landowners. Dealing with the petition of the Nottingham Corporation, witness said, with regard to the statement that there was a population of 235,000, which was rapidly increasing, as against 15,000 at Newark, the present supply from Farnsfield was sufficient if it was left alone. In his opinion, the Nottingham Corporation pumping-station at Papplewick was drawing water from the proposed limits; and if a well were sunk at Oxton it would really be a question which set of engines was the more powerful, and which would get the mastery. There was no reason why Nottingham should have the parishes of Oxton and Epperstone any more than Newark, for they would be supplied with the same water. In his opinion, there was an alternative scheme which could be adopted for supplying Nottingham for all time without affecting anybody.

In cross-examination by various Counsel, witness stated that Newark, with a population of 15,000, proposed to have water limits extending over 140 square miles. He admitted that it was a smallish town wishing to protect a large area. They bought the water-works in 1891, up to which time there were no water limits; but they were put into the Bill of that year. When the Corporation sunk their well 11 miles from Newark, they were certainly not marauding. The town was being supplied with filtered Trent water—typhoid water; and the Corporation went to the nearest available point for getting the pebble bed water. The existing area was about 40 square miles. The Bill was not actually required for the needs of Newark; and he admitted that it was a counter-move to the Nottingham Bill, and was designed to prevent encroachment on the Newark supply. The Corporation had no other object than to obtain protection. Supposing the Bill were rejected, nothing would be taken from Newark until the proposed wells were sunk by Nottingham, and then the water would be drawn away. The population supplied by Newark outside the borough was about 8000; and to the whole of the area 700,000 gallons of water a day were supplied. A large quantity, however, was used for brewing. He did not think there was any tendency of the outside population to decrease. Newark would lay all the necessary pipes for the supply of the new district. The Corporation had never asked for a guarantee before they gave the supply; but he was not willing to come under an obligation not to ask for one. Supposing they obtained the powers sought, there was nothing to prevent the Corporation sinking their well deeper. They might increase their output at Farnsfield; but there was absolutely no difference between the promoters and Mansfield in this respect, for they were in the same pebble bed. The Corporation proposed to take 26 more parishes; and they would be empowered to supply them, but not obliged to do so unless it could be shown that there would be a profit for three years of 10 per cent. upon the capital sunk in the area. These parishes could give notice of their desire to have water; and if Newark refused to supply it, they could get it for themselves under the powers of the Public Health Act. Witness could not give a single instance of any official application from any parish in the Southwell district for a supply of water from Newark. His fear was of any authority getting within the area. He could not find any precedent for the present proposal of Newark. They did not care about supplying all the parishes mentioned in the Bill; but if they took charge of all the water, they must offer to supply them. With regard to Lord Savile, witness admitted that the Bill would restrict him from selling water on his estate to the peril of the Newark supply; and as to the Duke of Newcastle, the measure would, in effect, protect his water. He acknowledged that the Bill had been inspired by fear, and not by any philanthropic feeling towards the parishes that would come under its provisions. It proposed to restrict the sale of water out of the Corporation's district, but not to give compensation for any interference with the rights of any private landowners.

Re-examined: Supposing both the Newark and Nottingham Bills were thrown out, Nottingham might go to Lord Savile and buy a portion of land, and so do Newark precisely the injury they were trying to prevent. They might sink a well within a mile of Farnsfield. He heard what was said at the local inquiry at Nottingham; and he was still of opinion that the proposed pumping at Oxton would be injurious to the Farnsfield well, and he was apprehensive about the Woodborough well.

Professor *Boyd Dawkins*, F.R.S., examined by Mr. Hugh Hole, said he had examined the water bearing strata of the district in question on behalf of the Nottinghamshire County Council for the purpose of the inquiry which had been referred to, when he gave evidence on behalf of the Council. Having regard to the peculiar present condition of Newark, he considered that the restraining and excluding clause in the Bill was a very wise and reasonable one. He felt that the special conditions of the district were of such a nature that they required to be met by special enactments. The various bodies were drawing one against the other; and he thought it desirable that some stop should be put to the multiplication of pumping—not for the sake of one body, but of all. In his opinion, it would be impossible to sink another well of any magnitude in the area under consideration without affecting the general level of the water in all the wells. Witness then described the geological formation of the water-bearing strata. He said the pebble beds were sandwiched in between red marl and rocks. The reservoir being a subterranean one, it depended for its supply upon the rainfall; and the surface streams represented the overflow. He had examined the effect of the pumping upon the surface water. When he was at the Dover Beck last year, he found that it originally began at Fishpool, where there was a pond and water meadows. From that point for a distance of more than three miles the surface waters were conspicuous by their absence. It was perfectly clear that the desiccation was the result of pumping. The private wells in the area had either become dry or had had to be deepened. He also found that water was being sold to the cottagers in the desiccated area at ½d. per bucket. He visited the area again in January last; and, in spite of the heavy rains and snow, he found that it was still waterless, with the exception of some in one ditch. He had not been down any of the large wells, with the exception of the one at Farnsfield; but it was proved that more water was being drawn off by the wells than was percolating through to the underground reservoir. The evidence given at the Nottingham inquiry amounted to the fact that the water in the Papplewick well had sunk 20 feet between 1886 and 1894; and in the Bestwood well, 33 feet between 1885 and 1894. The Oxton well would tend to reduce the level of the water at Farnsfield, and also that which was on its way to the group of wells at Blidworth, Papplewick, and Bestwood. He thought Nottingham would not get any large permanent increase to its water supply from the making of these wells; and in his report to the County Council he specially pointed out that, in the interests of the large population of Nottingham, they ought to look to some large source of water supply away from their present area, just as Liverpool, Manchester, Birmingham, and other large towns, had done. This alternative scheme was the one which would be laid before the Committee.

Cross-examined: The underground water flowed across the line of least resistance; and in sinking wells at Oxton and Woodborough he did not think it was at all probable that a great deal of water would be pumped which would otherwise escape to the sea. Supposing Nottingham were to put aside these wells, he should think a very considerable supply would be obtained from Boughton. If this were sanctioned and the other two wells were refused, it would be better for everybody. The adoption of the Boughton pumping-station alone would also obviate the drying-up of the Dover Beck, and remove to a great extent the fear of Newark.

Thursday, April 1.

On the resumption of the proceedings this morning,

Mr. *J. Whittaker*, J.P., stated that his residence was between the Mansfield and Sutton-in-Ashfield pumping-stations. He had a good knowledge of the district; and, in his opinion, the Newark scheme was the better one, because Newark would take less water. Speaking with regard to the effect of the pumping over the area in question, witness said that the Blidworth well, which was originally 40 feet deep, had had to be deepened. The ponds in the district had also been greatly reduced. Whereas formerly they filled up in a week, now they did not do so in two months.

Professor *Boyd Dawkins* was then recalled, and cross-examined by Mr. Statham on his report to the Nottinghamshire County Council last year. Witness had declared that no fewer than 29 wells had been dried up or deepened; and this was evidence as to the general condition of the district. His report also stated that he had been informed that the Bestwood well could a year ago be emptied by 30 hours' continuous pumping. He agreed that the inhabitants on the Duke of Newcastle's estate had a deep interest in the preservation of the water in their area. In his opinion, the desiccation of this district was exceptional in its itensity, and was most disastrous to the landowners. All this indicated that the solution of the water problem lay in going to the Derwent.

Mr. Pembroke Stephens: You know what the Newark Corporation are asking for. Now, in your large experience, can you give me any instance where Parliament has granted a protective zone of the character applied for.

Witness: I cannot give a single one.

You will see that if you granted such a zone to Newark, you would be equally bound to grant it to other wells?—Yes; other wells ought to have it.

Just draw mentally a four-mile zone round the existing wells. What would be the state of things then?—It would be a series of interlacing and complicated circles. I should like to say that this indicates as clearly as possible the exceptional condition of this area.

And the utter impracticability of the Newark scheme?—No; I do not think so.

Mr. Pembroke Stephens: We do.

Alderman *Earp*, a member of the Newark Corporation stated that they opposed the application of Nottingham last year because they were advised that their interests were threatened. The object of the present Bill was protective. They did not anticipate much profit, as the population was too small. Newark was absolutely dependent upon its chief industry of malting, which required a good supply of water.

Cross-examined: But for the Nottingham Bill, Newark would not be in Parliament. They asked to be allowed to have undisturbed possession of a certain area. The Corporation were always advised that they could not get sufficient water underneath their own town. Before the sinking of the Farnsfield well, the supply was polluted by a mixture of River Trent water; and they suffered very much from typhoid fever. The Farnsfield scheme was considered the best. Newark was not under any obligation to supply water outside the defined limits; but the Corporation proposed to serve the whole of the extended area if called upon to do so, though it might be at a loss at first. Their intention was to supply the district without demanding a guarantee; and they were prepared to come under an obligation to this effect. What they feared was the Oxton and Woodborough proposals.

Mr. *G. J. Symonds*, F.R.S., said he had long been acquainted with Nottingham and its rainfall, and had prepared statistics and a diagram as the result of recent and special investigations. The average rainfall in the district was 26 inches; and the mean annual rainfall, 25 inches. The record of 26 inches applied particularly to the Dover Beck area.

His information was simply with reference to the rainfall; and he said nothing about what became of the rain.

Mr. *J. Mansergh*, M.Inst.C.E., stated that he acted for Newark in 1891, and at that time examined the district. Since then he had visited the extended area, and had been to the sites of the wells proposed to be sunk at Oxton and Woodborough. The object of the present Bill was simply to protect the Newark limits, and ensure the town a supply of water. In his opinion, Woodborough was a little too far from Farnsfield to affect it very materially; but the sinking of a well at Oxton would produce a contest between the Oxton and Farnsfield wells, in which Newark would suffer. He knew of cases where Parliament had protected water authorities from the invasion of others. He instanced the protection given to the Lancaster Corporation in 1876, and to the Croydon Corporation in 1884. He said it would be a great number of years before Newark could get any profit from supplying the outlying parishes. It was clear, from the evidence given at the Nottingham inquiry, that the underground reservoir was being drawn upon too largely. The diagram prepared by Professor Symonds clearly proved that there was some abnormal condition which tended to desiccate the area of the Dover Beck; and this condition he thought was the exhaustive pumping at the various stations. The water in the stream was held up by the water below the ground. When pumping was not going on, the water rose to what was called the rest-level; but this had been permanently reduced. He understood that the pumping at Papplewick lowered the water 67 feet below the rest-level. He thought that the pebble beds were sufficiently drawn upon, and that no more wells should be sunk. He knew there was an alternative scheme, and had known of it for about twenty years. He was, in fact, surprised that none of the large towns had adopted it.

Cross-examined by Mr. PEMBROKE STEPHENS: He based his deduction that there had been some abnormal condition upon the evidence of Mr. Hawksley in 1869, that 6,300,000 gallons of water could be obtained each day from the Dover Beck, and upon the fact that under the same conditions of rainfall there were only 3,000,000 gallons now to be drawn upon. With reference to the Lancaster Corporation and the protection granted in respect of surface waters, he recognized the broad distinction between surface waters to which there might be an ownership, and underground water to which there was none. Anywhere within the statutory limits, the Newark Corporation could sink a well; and assuming that, with their present powers, they decided that they were not satisfied with the Farnsfield well, it would be competent for them to put down another. As to what would happen in that event to the Blidworth, Sutton-in-Ashfield, and other wells, it would depend upon the depth to which the well was sunk. There was nothing whatever to prevent Newark from sinking. But if they sought to preclude others from doing so, they ought to be willing to preclude themselves; and this was done in the Bill. At present, without a Bill, they could sink a well less than four miles from any surrounding well; but, of course, there would be opposition.

Replying to Mr. SHIRESS-WILL, witness said he had never known of a case where Parliament had been asked by a Corporation to draw a zone round a well.

Mr. ERSKINE POLLOCK: Supposing the Committee passed the Woodborough pumping-station, and rejected the one at Oxton, how would it differ from your Croydon case?

Witness: There would be no difference.

Mr. FREEMAN: Can you give me a single instance where such a thing as is proposed here has been done against the landowners?

Witness: No; I cannot.

Re-examined by Mr. LLOYD, witness stated that Newark could, if they pleased, pump all the water from under the land by means of their existing pump within a certain radius, irrespective of who might be the owner of the land above. They did not seek authority to add to the number of their pumps, but powers which would prevent landowners from sinking wells for the purpose of supplying water outside the district; and this was, he thought, essential for the protection of the town.

This was the case for the promoters.

Mr. FREEMAN said the Committee had rather a complicated position of things before them, and what he suggested was this: Up to the present, the Committee had heard the case on behalf of the Newark Bill; and he suggested that the opposition relating to that Bill, pure and simple, should be first heard, and then the Nottingham Bill be brought before the Committee, who could hear the opponents of both measures.

Mr. PEMBROKE STEPHENS objected to this course.

Mr. FREEMAN, proceeding, said it had been arranged that the opposition of Lord Savile should be first of all heard; and he was, of course, perfectly prepared to go into the whole facts and merits of the matter, to call witnesses, and to adduce absolutely unanswerable arguments against the Bill. But he thought he ought to point out, before they went into these facts and the merits of the case, that on the face of it there was something so unusual in the Bill that this was an ample reason why the Committee should say they did not wish to hear anything more with respect to it, and that as it now stood it must be rejected. On the face of it, the preamble simply related to two things—the construction of works and the extension of the limits of supply. There was not, from the first line to the last, a single reference to what the witnesses for the promoters said was the sole object for which the Bill was introduced. Mr. Mansergh said it was simply protection, by making an area; and he stated farther on that the Corporation of Newark did not care for the supply of the outside districts. He (Mr. Freeman) asked the Committee to say that a Bill so brought in was grossly unfair to landowners and others. It was not until they came to nearly the last clause that they found power slipped in which everybody now admitted was absolutely without precedent in the history of Bills, and which would revolutionize the whole rights of landowners in relation to water undertakings and common law. He asked the Committee, as a preliminary point, to say that the Bill did not comply with the fundamental rules of Parliament, and that it was not one on which the opposition ought to be asked to tender evidence.

The CHAIRMAN, after a brief consultation with his colleagues, said the Committee would like to hear the views of the promoters.

Mr. BALFOUR BROWNE said the point mentioned was the merest technicality ever raised. It was common ground between them that the district of Oxton and that farther south were badly in want of water. The Corporation of Nottingham proved it before the Local Government Board Inspectors. If his learned friend took the point that the promoters had not proved the case for the Bill, he would ask the Committee to allow them to call evidence to do so; but he did not think it was required. They could prove it up to the hilt; and if his learned friend Mr. Pembroke Stephens would so far tell them his case, he would also tell them that he was convinced of the necessity of somebody supplying these districts.

Mr. FREEMAN said his friend's witnesses had come one after another and had said that there was nothing in the Bill of any importance, or that the promoters cared about, except one protecting clause. There was nothing at all in the preamble as to what was said in the important part of the Bill.

Mr. BALFOUR BROWNE said it was impossible to put in the preamble everything contained in the clauses. The preamble merely set forth what was to be done under the Bill, mostly in the way of works.

Mr. FREEMAN said it was a distinct understanding in Private Bill legislation that the preamble should set out the main object of the Bill. If the Bill smuggled in the real object, then he said it did not fulfil the recognized requirements of that House and of the House of Lords. On behalf of the landowners, he contended that they were put in a false position in this case; and his learned friends joined him in the application that the Committee would say that the Bill was a vicious one, and ought not to pass.

The room was then cleared. On the re-admission of the public,

The CHAIRMAN said the Committee had considered the preliminary objection to the Bill being further dealt with, and had come to the conclusion not to sustain the objection.

Friday, April 2.

This morning, the case for Lord Savile, the largest landowner affected by the Bill, was proceeded with.

Mr. *G. Hodson*, M.Inst.C.E., said he had constructed water-works for Mansfield and Sutton-in-Ashfield, as well as for the Duke of Portland and Lord Savile. He had consequently had ample means for learning the geological conditions of the district. He described the water-works on Lord Savile's estate. The reservoir was situated close to the one proposed in the Bill, and there was not the slightest difficulty in supplying the village of Eakring from it. Lord Savile's works were capable of furnishing 150,000 gallons of water a day; being equal to 160 gallons per head of the population. If the Newark Corporation laid pipes through the villages of Rufford, Eakring, and Bilsthorpe, they could not supply the water so cheaply as Lord Savile. Witness produced a model of the geological formation of the county of Nottingham, showing the sites of all the existing pumping-stations and the proposed new wells. In his opinion, there was no connection with the Rainworth watershed and the Newark watershed. Regarding the whole of the area in question from the point of view of water-supplying purposes, the water was running away to the sea, and taking the line of least resistance. What the water-works engineer had to do was to place his works in the best spot for intercepting the water as it flowed on to the sea. Supposing a well was sunk upon Lord Savile's estate in one watershed, it could not affect the pumping in the other. He should say that the estate was the most prolific watershed in Nottinghamshire. In the immediate neighbourhood there were valuable coal-fields which were rapidly being opened out. Villages were springing up, and water would necessarily be required for them. If Lord Savile were able to supply water to the collieries and villages, he would have a most valuable property. The proposal in the Bill was to prevent this. In his opinion, it was not necessary, in order to protect the Newark well, to include any portion of Lord Savile's estate in the area. There was ample water within the existing limits of the Newark supply without going outside. The true solution of the problem was to exclude from the Bill the whole of Lord Savile's estate.

In cross-examination by Mr. LLOYD, witness admitted that an agreement had been come to by Lord Savile with the Nottingham Corporation, who consented to pay his Lordship £460 a year on condition that the landowners should reserve to them an area of two miles round the Boughton site, in which nobody should be allowed to sink a well. The principle was the same as in the case of Newark, but with this difference—that Nottingham had purchased the right, and Newark proposed to simply grab it. The Newark Corporation did not want the water themselves—they merely wanted to act the part of the dog in the manger; and if their proposals were adopted, all the authorities in the southern part of the district who wanted water must necessarily go to them and buy up their interests. The particular land to be reserved had been settled; and it was within the two-mile radius. The Boughton site was fixed by the Nottingham Bill; but supposing the Corporation did not find water at this particular spot, they were entitled to go on any of the owners' ground within half a mile. It was not necessary, for the protection of Boughton, for Nottingham to have the two-mile radius; but they were going to have it because they were paying for it. Being pressed on this point, witness said there might not be an absolute necessity for a zone of protection; but personally he would have it if he could get it cheap. With regard to the other landowners, Earl Manvers would get £200, and the Duke of Portland would have certain rights secured by a clause.

Mr. *Lipscombe*, the steward to Lord Savile, said that, if water were wanted, his Lordship would be willing to arrange for a supply. He (witness) regarded the water in the strata beneath the estate as a large factor in looking at its worth, especially in view of the depreciated value of the surface. If the coal-fields were going to make populous villages in the neighbourhood, it would be the grossest interference with the rights of Lord Savile to sanction the proposals of the Bill.

In cross-examination by Mr. LLOYD, witness said he understood there was no intention to prohibit Lord Savile from selling water on his own estate within the added limits of Newark; but his point was that Newark sought to prevent his Lordship from exercising his rights, and selling the water outside his estate. If Newark did not propose to come to the three villages on the estate unless they were invited, then the proposal to lay pipes and make a reservoir in the district was a gross sham.

Mr. FREEMAN announced that this was his case, and that he proposed to address the Committee upon it.

Mr. BALFOUR BROWNE objected, on the ground that his friend had addressed the Committee on the previous day. Mr. Freeman, he said, elected to speak before he called his evidence, and took what he thought to be a fatal objection to the Bill. A second speech was contrary to the practice at the Bar.

Some conversation on the matter then took place; and eventually the Chairman asked Mr. Pope to give the Committee the benefit of his long experience.

Mr. POPE said the objection taken by Mr. Freeman on the previous day was rather in the nature of what in the Courts would be called a claim of non-suit; and if such a claim were disallowed, the party making it would be entitled to go on with his case just as if no claim had been put forward. The point was really a question of fact—whether Mr. Freeman, in putting forward the preliminary objection, had taken the opportunity to go into the merits of the case.

The CHAIRMAN said that, in the opinion of the Committee, Mr. Freeman had referred to the merits only so far as was necessary to support his application.

Mr. FREEMAN then addressed the Committee in support of Lord Savile's petition against the Bill. He said, as regarded his Lordship's position, the Committee had had the plan before them, and they knew that the estate practically comprized the whole of the three parishes sought to be included within Newark's limits of supply. There was no question that in the district there was a magnificent underground source of water, which was becoming a constantly increasing factor in the value of the estate. There was plenty of water, and works were already constructed; and the reason why the inhabitants of the parishes were not supplied by Lord Savile was because they had wells of their own. But the moment these failed to be sufficient, from Lord Savile's reservoir a supply of most excellent water could at once be furnished by his Lordship far more cheaply than by anybody else, because the supply was there, and very few pipes would have to be laid. They had had evidence of two things—first that there was a very rich coal-field now beginning to be developed; and it was common knowledge that as soon as pits were sunk villages quickly sprang up about them, and these required to be promptly supplied with water. Directly the villages came into existence, they might ask Lord Savile to supply them; and therefore he would in the immediate future have customers out of whom he could make large profits. Dealing further with the evidence given in support of the Bill, the learned Counsel said Mr. Mansergh acknowledged that the whole scheme was simply and purely one of protection. But the Nottingham Corporation, with their proposed large works at Boughton, felt it only necessary to take the small radius of two miles; and assuming that a radius of any kind was required, if one of two miles was sufficient for Nottingham, why should Newark seek to obtain one of four miles? The Nottingham Corporation had the common honesty to say they wanted to get water, and would pay for it; and for every scrap of the two-mile radius they were prepared to pay a reasonable amount. Let the Committee contrast with this what Newark was proposing to do by the Bill. What Nottingham was paying for, Newark proposed to grab. He ventured to say that the Bill contained a startling and somewhat revolutionary suggestion, and one wholly without precedent; and he hoped it would fail.

This closed the case for Lord Savile.

Monday, April 5.

On the re-assembling of the Committee this morning,

Mr. STATHAM presented the case for the Duke of Newcastle. He said that if his Grace was satisfied that the Bill was a reasonable one, and had been promoted by the inhabitants of a large town, he would be very reluctant to stand in the way of a public improvement; but instead of being an advantage, he contended that it would be altogether to the detriment of the district. Why should not Newark come forward with a fair-minded and reasonable proposition which would not alarm the landowners for miles round? The Duke was there to oppose the Nottingham Bill; but he (Mr. Statham) was pleased to say that Nottingham had met them in the spirit one might have expected from a high-minded Corporation, and the Committee would therefore be no longer troubled with their opposition. But what was the attitude of Newark? Newark denied them their common-law rights. In promoting their Bill, the sole object had been to have the first word and the last; and they had either misconceived matters, or had wilfully tried to avail themselves of the machinery of the House to establish a dangerous precedent.

The case for Sutton-in-Ashfield was then taken.

Mr. *J. Pickard*, a member of the Nottinghamshire County Council, and Chairman of the Water Committee of the Sutton-in-Ashfield District Council, examined by Mr. TOLLER, stated that he was on the old Local Board in 1885, when it became necessary to establish water-works, owing to the hardness of the water and the pollution of the streams in the neighbourhood. The district was a largely increasing one by reason of mining operations. The total amount expended by Sutton-in-Ashfield on its water supply was £53,865. They had purchased a site called Blidworth Bottoms for £2000, with the intention of making another well; but, in view of the rapidly increasing population of the district, this was regarded as being only of a temporary character. The area of the district supplied extended over 19,712 acres. In 1871, the population was 16,381; in 1881, it was 22,984; in 1891, it was 30,967; and now it was estimated at 40,000. Consequent upon this increase, further water supplies would be required from the pebble bed area.

In cross-examination by Mr. BALFOUR BROWNE, witness said he was not aware that the Engineer to the Sutton-in-Ashfield Council advised them to sink a well near to the Newark well at Farnsfield. He could not say whether the Oxton well would affect the Sutton-in-Ashfield well; and he did not know that Newark proposed to protect the whole area, and so protect the Sutton-in-Ashfield well. Sutton was opposing the Nottingham Bill as well as the Newark Bill. They were not supporting Newark because they wanted more water.

Mr. BALFOUR BROWNE: You want to prohibit us because you want to sell water out of your own limits at a profit.

Mr. TOLLER said this was all the evidence he proposed to call. Addressing the Committee, he contended that Parliament ought to protect the interests of the inhabitants of the district he represented as opposed to the claims of Newark. He submitted that the whole object of the Bill was to checkmate Nottingham. Newark asked Parliament to give them a supply of 7,800,000 gallons of water a day when the whole quantity they wanted for trade and domestic purposes was only 690,000 gallons, allowing 7,000,000 gallons a day to find its way to the sea without anybody being able to appropriate it. Was that a fair and reasonable scheme? He asked the Committee to say that it was neither, and that the preamble of the Bill was not proved.

The Southwell Rural District Council were next heard.

Mr. *W. H. Radford*, Assoc.M.Inst.C.E., of Nottingham, said, in answer to Mr. READER HARRIS, that he had carefully considered the effect of the proposals of the Bill upon the Southwell Rural District Council's district. It contained 60 parishes, and 26 of them were included in the extended area. The only reason for the Bill was opposition to Nottingham. The water supply of the parishes in the Southwell district was such that they did not require a further supply from the Newark Corporation. The effect of the inclusion of the parishes would be very disastrous to them, for it would practically deprive them of their water and the Council of their power as a water authority. He did not know of any precedent for such a proposal as that made by Newark, nor was there any need to create one in the present case.

In cross-examination, witness admitted that a local authority who had sunk wells should have protection against other authorities. Parliament had always granted this protection; but it was a new thing to ask them to give it before they had the opportunity of hearing claims. He thought that by so doing they would be prejudging any case. He did not consider Newark ought to be protected against some future authority whose scheme Parliament might find would not be injurious to the town.

In answer to the Chairman, Mr. BALFOUR BROWNE said the Corporation did not seek more protection in the added limits than they had in the existing ones; but they wished to have in addition the power to prevent persons from sinking a well and taking water out of the district for purposes of sale. By the Bill, the Corporation undertook not to sink any shaft within the extended limits, nor was anyone else to do so. They prohibited themselves only so far as the added area was concerned.

Mr. READER HARRIS then addressed the Committee on behalf of the Southwell Rural District Council. He said that at present Southwell had a right to supply their locality; but the Bill proposed to take this away. Nottingham had great need of water; Newark had not. The Bill was simply an application for protection against an imaginary evil. Let Newark have protection by all means; but it ought not to interfere with the responsibilities, privileges, and rights of the water and sanitary authority of a district like that which he represented. He asked the Committee to declare that the preamble of the Bill was not proved; but if they saw fit to grant some part of the application, he would ask them to restrict the area of protection.

Mr. SHIRESS-WILL next opened the case for the Mansfield Corporation, and proceeded to call evidence.

Alderman *R. Barringer*, the Mayor of Mansfield, said the water-works were originally in the possession of a private Company; but in 1889 they were purchased by the Local Authority for £29,850. The water obtained from the then well was not considered adequate or satisfactory; and the Corporation erected the Rainworth pumping-station at a cost of £27,200. With the sanction of the Local Government Board, they supplied water to three outside places, the total population to be served being a substantial increase upon 24,001, the population of 1891. With this augmented population, the Corporation had felt it to be their duty to appear before the Committee in order to protect their water supply. The proposed four-mile limit of Newark would be no protection to the Mansfield well. The Mansfield Corporation were advised that when they required another well, they would have to put it within the four-mile radius.

Tuesday, April 6.

Before the case for Mansfield was proceeded with this morning,

Mr. BALFOUR BROWNE made a statement to the effect that he opened the case for the Newark Bill with the idea that Newark, like other people, would be precluded from sinking further wells outside their own property within either the existing or the proposed extended area of supply. This was what he felt to be fair; and though the Bill as printed was different, he could, of course, prohibit Newark in the way suggested.

Mr. PEMBROKE STEPHENS said his friend could not have power to alter the Bill; but he could override his own rights under the Act of 1891.

Mr. BALFOUR BROWNE observed that he would carry out the expressed intention in any way that might be suggested.

Mr. SHIRESS-WILL remarked that his learned friend was rather late in finding out the enormity of the Bill; but he must tell him that what he proposed would not do away with Mansfield's opposition.

Mr. *Hodson* was then called, and stated that he was consulted by the Mansfield Corporation with regard to their water supply, and advised the sinking of the present well, which was capable of furnishing 750,000 gallons in ten hours. They pumped 25 gallons per head per day for a population of 30,000; and this had been found to be quite ample. The extended limits of Newark came within 33 yards of the Mansfield well; and assuming they were allowed the four-mile radius, it would be less than half a mile from the well. As the Bill stood, Newark would have power to sink within 1½ miles of the Rainworth pumping-station. Some years ago, he pointed out that Mansfield must go for a further supply of water to Rainworth; but if the Bill passed, this would become impossible, whether it contained the larger area or the four-mile circle. If the proposals contained in the Bill were sanctioned, 7,800,000 gallons of water would be wasted daily, as, being untapped, it would flow to the sea. It was not at all necessary for Newark to have the four-mile radius.

In cross-examination, witness said he thought Newark had ample protection through Parliament or the Local Government Board. He did not know that in two cases bodies were allowed to make works within the existing limits of a local authority.

Mr. SHIRESS-WILL then addressed the Committee on behalf of Mansfield. He said the Corporation were before them in no spirit of aggression, but merely to protect the interests of the inhabitants supplied by them. Newark were asking for a title against all their neighbours upon the pebble bed area. This was a monstrous proposition. If Newark desired to defend the interests of their population, were not other people equally concerned in protecting the interests of theirs? Even reducing the claim of Newark to the four-mile radius, it would mean that several villages would be left out in the cold. Whereas Newark could only pump 1 million gallons a day at the outside, they proposed to allow some 7 million gallons to run to waste, and all because their well wanted to be protected. He ventured to say, first, that there was no precedent for the Bill; and, secondly, that if there was one, Newark had not made out any case. This being so, he asked the Committee to reject the Bill.

Mr. ERSKINE POLLOCK followed on behalf of the Nottinghamshire

County Council. He said he did not propose to call any further evidence, because that on which he should found his observations was already before the Committee. He wished to say, at the outset, that the Council had not the same direct interest as the landowners or the local bodies. The interest of the Council was that of the whole district; and it was their duty to appear in protection of their administrative county. He characterized the promotion of the Bill as a move on the part of Newark to anticipate everybody else; and was it fair, under the circumstances, that the Committee should be asked to sanction it? The promoters had not even tried without a Bill to get the protection they sought. There had been no attempt to get a zone of protection by arrangement before asking Parliament for these extraordinary powers—powers which absolutely confiscated the rights of the landowners, and interfered with those of local authorities. He contended that there was no pressing need for water, and that if the Bill were thrown out Newark would not suffer. He asked the Committee to reject the scheme as being crude, unfinished, and not properly thought out.

This completed the opposition to the Bill, with the exception of that of the Nottingham Corporation, whose objections were laid before the Committee in the opening address for the Corporation's own Bill, which was then proceeded with. A report of this portion of the inquiry will be given next week.

LEGAL INTELLIGENCE.

CHESTER COUNTY COURT.—Thursday, April 22.

(*Before His Honour Sir* HORATIO LLOYD, *Judge.*)

A Question as to the Preferential Claim of a Gas Company against a Debtor's Estate.

His Honour to-day gave judgment in this action, which was brought by the Mold Gas and Water Company against Mr. A. F. Dodd and Mr. T. Lewis, Trustees under a deed of assignment by one Maddox in favour of his creditors, to recover £37 17s. 8d., being the moiety of a sum of £75 15s. 4d. for gas and water supplied to the Black Lion Hotel, Mold, formerly occupied by Maddox. The case was tried at a special sitting of the Court on the 27th of January (see *ante*, p. 241); and his Honour reserved judgment.

Mr. S. MOSS appeared for the plaintiffs; Mr. COLLINGWOOD HOPE for Mr. Lewis; and Mr. F. BROADBRIDGE for Mr. Dodd.

It was contended for the plaintiffs that the Company's claim was a preferential one, and that therefore it would have to be paid in full; moreover, that there had been a promise by the Trustees and the Committee of Management to pay the whole amount of the debt. For the defence, it was argued that the plaintiffs had released Maddox without having any claim against the defendants.

His HONOUR, in giving judgment, said he found on the evidence that a promise was made to pay the plaintiffs' debt in full; but there being no memorandum committed to writing sufficient to take the case out of the Statute of Frauds, that statute must prevail. Therefore he did not see that he could do anything else than give judgment for defendants. Having practically made the promise, they were not bound by it because it was not in writing; and there was no sufficient part performance to dispense with the legal formality which was required. With regard to the question of costs, he was disposed, if it would put an end to litigation in the matter, not to allow costs to anybody.

Mr. Moss said he was instructed to ask his Honour to give plaintiffs leave to appeal, as this was a very important case.

His HONOUR said they would not require leave. He would say nothing about the costs for a week. If the plaintiffs liked to appeal within seven days, he would make the order: "Judgment for defendants, with costs." If they did not appeal, he would adhere to what he had said, and not allow costs to anybody.

A Disclaimer.—Mr. W. Croxford, the Secretary of the Brentford Gas Company, asks us to notify that he is in no way connected with the Charles Hammond Croxford who was recently charged at the Westminster Police Court with embezzlement, as reported in the "JOURNAL" last week.

Outburst of Fire at the Rochdale Road Gas-Works, Manchester.—On the morning of Saturday, the 17th inst., while a gang of ten men were engaged in changing the oxide of iron purifiers at the Rochdale Road Gas-Works of the Manchester Corporation, the escaping gas suddenly became ignited, and the men were caught by the flames and burnt. They were all removed to the Infirmary, where three had to be detained.

Tarapaca Water-Works Company, Limited.—The report for the past year states that the net profits for the year amounted to £48,378, which, added to the balance brought forward on Jan. 1, 1896, made a total to the credit of the profit and loss account of £67,393. The Directors propose to pay a final dividend of 4 per cent., making 7½ per cent. for the year; to place £10,000 to the account for redemption of the debentures, and £10,000 to the general reserve; and to carry forward £17,393. The amount set aside out of profits for the redemption of the debentures will now amount to £40,000.

Accrington Gas and Water Supply.—From a report lately presented to the Accrington and District Gas and Water Board, it appears that, during the year ending in March, 16,383 tons of coal were carbonized at the Accrington Gas-Works, producing 170,600,000 cubic feet of gas, as compared with 157,370,000 cubic feet in the preceding year, from 15,034 tons of coal. At the Great Harwood works 11,136 tons of coal were carbonized, producing 119,036,000 cubic feet of gas; the figures for the previous year being 109,844,000 cubic feet and 9441 tons respectively. The total make of gas at the two works was 289,636,000 cubic feet, or 8·38 per cent. increase on the year 1895-6. At the end of March, the four reservoirs belonging to the Board contained 510 million gallons of water, as compared with 467,200,000 gallons at the same period last year.

MISCELLANEOUS NEWS.

THE NEW RETORT-HOUSE RULES AT THE LEEDS GAS-WORKS.

The Men's Objections—A Strike—The Men Agree to Try the Rules.

In previous numbers of the "JOURNAL," reference has been made to the dissatisfaction among the men employed at the Leeds Gas-Works with the new code of rules framed by the Gas Committee in regard to the work of the machine men and attendants in the two retort-houses at New Wortley where mechanical stoking has been introduced. It was notified some weeks ago that these rules were to come into force last Thursday; but it was only at a meeting held on Sunday, the 11th inst., that the men determined to submit an alternative set embodying their views on the points objected to. The complaint of the men, stated in general terms, is that, under the new arrangements, the conditions of labour will be made too hard. The Committee, on the other hand, contend that the rules are reasonable, and have been based upon regulations controlling similar work in other towns. A comparison of the new rules with those drafted by the men, reveals numerous differences. In the first place, the Committee's regulations apply only to machine men and attendants in the retort-houses where mechanical stoking is in use. The men desire one code of rules to be applicable to all the workers—stokers, firemen, coal wheelers, coke slakers, machine men, and attendants. With the Committee the Gas Workers' Union agree that there should be three shifts of eight hours each; that no man should leave the works without having obtained permission from the Manager or his foreman; that Sunday work should only be done when required; and that labour on that day should be remunerated at the rate of time-and-a-half for all three shifts. In the next rule, the Committee stipulate that "any workman wishing to be away from work must make personal application to the Manager or the foreman before twelve at noon on the previous day, so that arrangements may be made for filling his place." The Union object to the words "before twelve at noon on the previous day," and substitute "six hours previous to his shift." The fourth rule is the same in the two codes. It states that Christmas Day, Good Friday, Whit Monday, and the first Monday in August "shall be considered as holidays, for which ordinary wages shall be paid, and that double wages be paid to such men as are required on these days." From this point the divergence of opinion existing between the Committee and the Union becomes more marked. The Committee in their fifth rule define the duties of a machine man. The Union, in their draft rules, go on to deal with stokers, firemen, coal wheelers, and coke slakers; reaching the consideration of machine men in their ninth rule. The Committee say: "Machine men must keep their machines in good order, properly draw and charge the retorts, and report to the foreman any defect in their machines requiring the attention of the fitter, whom they must assist as far as possible. Each machine man shall draw or charge 280 mouthpieces per shift; but in case of letting down retorts, he will be required to make up his full amount of work as the Manager may determine." To the latter portion of this rule the men do not allude. They agree that the machine men ought to keep their machines in good order, and properly draw and charge the retorts. They are of opinion, too, that it is a machine man's duty to promptly report to the foreman any defect in a machine requiring the attention of the fitter. In regard to one of the retort-houses, they think the Committee's demand reasonable that a machine man shall draw and charge 280 mouthpieces per shift; in the other, where a different type of machine is at work, they are of opinion that 170 mouthpieces are quite sufficient for a man to look after. Concerning the nature of an attendant's duty there seems to be little difference of opinion between the Committee and the Union. Both agree that "attendants must take off, clean, lute, and put on retort-lids; or, in case of sealing lids, must open and shut the lids, keep the lids and mouthpieces clean, stop all lids blowing, keep the rails clean, clear away coal from the charger-pan, and wheel same to breakers." A couple of restrictions which the men add in their rule might, however, be noted. They desire that attendants should wheel out and tip all coke where required, "but in no case shall the distance exceed 55 yards from mouthpiece to tip." They wish, also, that an attendant's duty as to the ascension-pipes should be limited to keeping these pipes clear to the extent of 3 feet. An addition they suggest to the Committee's rule is that attendants shall change sides weekly, and that "men must take every job in turns." But it is in reference to the number of men to be employed rather than in the nature of the work, that the most serious difference of opinion exists. The schedule of work is set out by the Committee as follows: Number of retort mouthpieces, 420; number of draws per shift, 560; number of charges per shift, 560. "For this," the rule continues, "there will be four machine men and twelve attendants; but where the lids are luted, there will be fourteen attendants." In one of the retort-houses, where West's machines have been introduced, the lids are self-sealing; in the other, where Foulis's machines are at work, the lids have to be luted. The operation of removing, luting, and replacing these lids, the men say, is a laborious one; and they contend that the two additional men proposed by the Committee are insufficient. As an alternative to the Committee's schedule of work, they suggest the following: West's machines: Number of mouthpieces, 420; draws per shift, 560; charges per shift, 560; machine men engaged, 4; attendants, 14. Foulis's machines: Number of mouthpieces, 472; draws per shift, 629; charges per shift, 629; machine men, 8; attendants, 19. The men are also opposed to attendants wheeling out scattered coke. Respecting wages, there is no serious difference of opinion. The Committee consider 5s. per shift a reasonable wage to pay to machine men, attendants, and firemen—provided, of course, they do the work stipulated in the code. Another matter upon which the men disagree with the Committee has reference to the length of notice that a man shall give to terminate his employment. The Committee say that machine men, elevator men, firemen, and attendants shall give 28 days' notice. The Union think 14 days' notice is quite long enough.

The Committee naturally defend their rules; and they maintain that, under them, greater consideration is given to the men than is shown to gas workers in the majority of places. The policy of the Committee all

along has been to render the introduction of machinery into the works as little obnoxious to the men as possible. Instead of discharging all the surplus hand stokers, they found many of them employment in the machine-stoking houses. Though for a time the results were not, they say, so satisfactory as if men used to the work had been imported from other towns, yet, in consideration of their fellow-citizens, the Committee were prepared to make this sacrifice. The Committee now lament that these very men are turning against them. The working expenses of the machine-stoking appliances at New Wortley for the quantity of gas produced are said to be considerably more than in many other places where similar machines are in use. In the interests of the general ratepayers, the Committee do not see why this should continue. The number of men to be employed under the new rules is thought by the Committee to be quite sufficient for the work required. It is pointed out that when the retort-house with West's machinery was first opened, 14 attendants were employed. Since then the Committee have reduced the amount of work by 25 per cent., and still the same number of men are engaged. In the men's alternative rules, the Committee contend, it is sought to materially lessen the power of the Manager. There is no reference made in them to the Manager being allowed to reduce the number of men as occasion may require; neither is provision made for him to make a man do his full amount of work in case of letting down the retorts. One of the rules suggested by the men stipulates that an attendant shall in no case wheel out coke to a distance exceeding 55 yards. Such a rule as this, the Committee urge, would lead to endless confusion. Seldom are attendants required to wheel coke so far. When, however, occasionally, the distance from the mouthpiece happened to be a few yards over this distance, with such a rule in force, the attendant would have a right to dump down his coke a few yards from the tip. This would necessitate the employment of additional men to carry the coke the rest of the distance. With the men's rules in force, too, additional hands would be required to sweep up the scattered coke. The Union object to 28 days' notice being required before a man can determine his employment, as they consider 14 days quite ample. The Committee think the longer notice is necessary to secure the continuity of the supply of gas to the city. In the present instance, the hand stokers cannot legally leave their employment without 28 days' notice. These, briefly stated, are a few of the grounds upon which the Committee base the reasonableness of their rules. To meet the changed conditions caused by the introduction of machinery, new rules were necessary; and those framed are, they contend, fair to the general ratepayers and at the same time not unjust to the men. The latter, however, contend that the amount of work required of them by the new rules is unreasonable. Under the old hand-stoking system, the men state that they were each required to carbonize 60 cwt. of coal per shift of eight hours. Each man had to look after 18 mouthpieces, draw and charge them, and do other necessary work in the way of wheeling away and slaking coke. Now, it is said, the attendants in the Foulis retort-house work in batches of nine; and between them they have to look after 336 mouthpieces, lute the lids, wheel 336 barrows of coke, and slake it when tipped. They have not, however, to charge and draw the retorts as formerly. This is done by the machine men. Still, the attendants say, they have considerably more work to do than they had when hand stoking was in use. In the old days, they had plenty of leisure time. Now, they say, they are employed continuously for eight hours, with the exception of about twenty minutes or half an hour. This uninterrupted labour in close proximity to the hot retorts is, they assert, very oppressive; and the new rules would make it even more so. The luting of the lids, it is urged, is most laborious. The cleaning of the ascension-pipes is another grievance which the men have. Under the mechanical stoking system, this work, they say, has much increased. If the results obtained by mechanical stoking have not come up to the Committee's expectations, it is, the men say, because there have been too few hands employed. With more attendants at work, better gas, they maintain, would be produced.

Last Wednesday morning, Mr. Wood, one of the district officials of the Union, had an interview with the Chairman of the Gas Committee (Mr. Lowden) to see if some temporary settlement of the dispute could not be arrived at. He proposed that the operation of the new rules should be postponed for two or three weeks, to afford an opportunity of a conference taking place between the Committee and the men's representatives. Mr. Lowden could not see his way to consenting to any such arrangement. He pointed out that copies of the new rules were posted in the works a month ago. This, he thought, gave the men ample time for considering them, and making any representations they thought fit to the Committee. It was not, however, until the previous Saturday—in the middle of the Easter holidays—that the members of the Committee received copies of the alternative rules suggested by the men. The officials of the Union have offered an explanation of this apparently dilatory action on their part. It took the Committee, they say, nearly six months to draw up their rules. Could it be expected that the men would be able to draft a complete code of regulations in a few days? Working in three shifts, the men were not able to hold representative meetings during the week. Sunday was the only available day on which they could have such gatherings. Every Sunday since the Committee's rules were posted, the men have held meetings; and they contend that their alternative proposals were placed in the hands of the Committee with reasonable expedition. Of course, every day brings the time nearer for considerably slackening off the consumption of gas; and as the requirements grow less, a number of retorts will be let down. Last Wednesday, much to the surprise of the men, it was announced that the retorts in the building where the Foulis machines are erected would not be required on the following morning. As the result of this, 54 men ceased work. About a similar number of men were employed in the other building, where West's machines are in use; and it was these who were asked to conform to the new rules.

It was only to be expected, from the determined attitude of the two parties to the dispute, that a strike would be the result. This took place on Thursday morning. The men assembled as usual at six o'clock; but, instead of proceeding to work, they held a meeting, and appointed a deputation to wait upon the Manager (Mr. Bond) to inquire what course he was going to take. Mr. Bond readily received the men. On being asked if it was his intention to enforce the new rules, he replied in the affirmative; he must, he said, obey his instructions. He recommended the men to commence work; assuring them that the Committee would then be prepared to consider any representations they might deem it desirable to make to them. The deputation urged that it was impossible to do the work required with the reduced staff proposed by the new rules, the acceptance of which, they said, would mean the removal of five men from the retort-house. On the deputation reporting the result of their interview, the greater number of the men left the works. In addition to the attendants employed in West's retort-house, the majority of the firemen, yardmen, and purifiermen also left the premises. As far as could be ascertained, about 130 men refused to work; but besides these, some 50 or 60 men are out of employment owing to the suspension of work in the retort-house fitted with Foulis machines, as mentioned above. In the course of the morning, the men who had left the works held a meeting at the Gladstone Hall. The proceedings were of a private character; only members of the Gas Workers' Union being admitted. Representatives of the Press were informed that the meeting was of an enthusiastic character, and that the men determined not to return to work under the new rules. Mr. Wood had reported the result of his interview with the Chairman of the Gas Committee the previous day. He said he proposed to Mr. Lowden that the men should be allowed to continue work under the old conditions for a fortnight; as this would afford an opportunity of a conference taking place between the Committee and the men's representatives. Mr. Lowden could not see his way to agree to such an arrangement. He promised, however, that if the men would work under the new rules the Committee would receive a deputation from them and consider their demands. To such a course, Mr. Wood informed him the men would not agree; and this action received approval. The situation was then discussed. A resolution was moved and seconded, to the effect that the men do not resume work under any conditions except those stated in the alternative code of rules drafted by the Union. To this an amendment was proposed that the men consent to resume work under the old conditions for a fortnight, in order to give an opportunity of a conference taking place with the Committee. This amendment was heartily supported by Mr. J. Smith, the principal district official of the Union. He urged the men not to pass any such arbitrary resolution as the one first proposed. To do so, he urged, would considerably lessen the chance of an amicable settlement of the dispute being arrived at. They must show the public that they were willing to discuss matters with the Committee, and that they were anxious for peace. The voting upon the two proposals before the meeting was limited to the men engaged at the New Wortley works; and, by about 90 votes to 60, they adopted the amendment. A Strike Committee was then appointed; and arrangements were made for picketing the works.

In the afternoon, a letter was forwarded from the Union to the Chairman of the Gas Committee, informing him that the men had held a meeting and discussed the circumstances which had brought about the dispute, and also the most reasonable method of effecting a settlement; and they submitted the suggestion that the men should resume work under the old conditions for a fortnight (without prejudice), so that the whole matter might be thoroughly dealt with by the Committee and the Union officials, to see if a settlement satisfactory to both sides could be arrived at, and so avoid continuing the present dispute, which "might develop into one of the most serious ever known in the district."

When the men left the works, the fires were not allowed to go out. Ten machine men, non-members of the Union, who came to the city with West's machines, remained at their posts. About half-a-dozen yardmen also declined to leave the premises. With this staff, augmented by about a dozen clerks employed on the premises, the fires were kept going all day; and the gasholders indicated that their efforts were not without effect. Mr. Townsley (the General Superintendent) and Mr. Bond lent helping hands. The six yardmen performed their usual duties in the yard, but declined to aid in firing. Provisions were supplied to workers on the premises.

On Friday, the outlook was more hopeful than on the previous day. Both the Gas Committee and the Union officials realized the serious consequences that would ensue from a continuation of the dispute. The men held another meeting in the Gladstone Hall, at which deputations from the other gas-works (at Meadow Lane and York Street) were present. Mr. Smith reported that, in accordance with the resolution passed on the preceding day, he forwarded a letter to Mr. Lowden, stating that the strikers were willing to return to work for a fortnight on the old conditions, in order to give the parties an opportunity of coming to some arrangement. Mr. Lowden had replied, stating that he had convened a special meeting of the Gas Committee to consider the men's proposals. This was held in the afternoon, and was numerously attended. Mr. Townsley and Mr. Bond were present. The letter received from the Union officials was read, and a brief discussion followed. The Committee agreed that no possible chance of a settlement of the dispute should be ignored; and a conference with the men, they admitted, might lead to the discovery of some method of ending the conflict. At any rate, such an interchange of views could do no harm; and they heartily approved of the Chairman's suggestion that they should invite a deputation from the men to meet them on Saturday. The Town Clerk (Mr. J. Harrison) was instructed to communicate this desire to the officials. On receipt of the letter, Messrs. Smith and Wood conferred with some of the men, and selected six of them to attend the meeting of the Committee. In consequence of the arrangement of this conference, the general meeting of gas-workers employed at the three works, which was to be held in the evening, was postponed until Sunday morning. The temporary working staff commenced operations about half-past seven o'clock on Thursday morning, and continued at work until half-past ten at night; the process of carbonizing going on till four o'clock in the morning. On Friday morning, work was resumed at eight o'clock, and ceased about ten at night. Arrangements were made for supplying the temporary needs of the men, whose meals were brought to them on the works, where also sleeping accommodation was found for the clerks. These thirteen volunteers were doing the work which under the new rules would be apportioned to seventeen men.

The conference between the Gas Committee and the men's representatives took place on Saturday afternoon at the Municipal Buildings, and lasted nearly five hours. Rule by rule was gone through, with the view of ascertaining precisely the nature of the differences existing between the parties. The Committee quoted many figures to show that the working expenses in connection with machine stoking appliances in other towns are less than in Leeds. On the other hand, the men

dwelt on the varying conditions of labour that prevail in the different towns. The result of the interview was to show that only upon two points does any very serious difference of opinion exist. The first and most important of these has reference to the number of attendants who shall be employed; the second relates to the number of days' notice that a man shall give before terminating his employment. Upon the first matter the Committee say that nine attendants per shift in West's house are sufficient; the men's deputation contending that this number is much too little. As to the number of days' notice to be given, the Committee think 28 days reasonable; the men, on the other hand, belivee that 14 days' notice is ample. After the deputation had withdrawn, the Committee considered the various points that had been raised; and eventually they passed the following resolution: "That the men be allowed to go to work under the Gas Committee's new rules for a fortnight, and that during that time the Committee meet the representatives of the men to further discuss matters." At the invitation of Mr. Lowden, the members of the Committee and the deputation afterwards adjourned to the Conservative Club for tea, during which Mr. Smith gave an invitation to the members of the Committee to be present at the men's meeting. This was held on Sunday morning, in St. James's Hall; 300 men being present. Two members of the Gas Committee—Messrs. Ratcliffe and Brown—attended, and received a hearty reception. They counselled the men not to allow their enthusiasm to get the better of their discretion. Let them, they said, try the task the Committee set them; and if they showed it was an unreasonable one, the Committee would be only too glad to put matters right. Before retiring, the two Councillors were accorded a hearty vote of thanks for having attended the meeting. Afterwards the men proceeded to discuss the general situation. At first it rather seemed that the Committee's resolution would not be accepted. Speaker after speaker got up and condemned the new rules; characterizing them as unjust and "impossible" of fulfilment. Mr. Smith and Mr. Wood took another view of the situation. They urged the men to try them; assuring them that they had only to prove that the work was unreasonable to get public opinion on their side. Eventually, by a large majority, it was decided to accept the resolution, and to return to work. At the conclusion of the meeting, instructions were given for the picketing of the New Wortley Works to cease; and Mr. Bond was requested to make arrangements for the return of the men on the following morning. In addition to the attendants and firemen, to which reference has been made, the yardmen and purifier men would also return to work. The Committee were to be invited to visit New Wortley to see for themselves the nature and amount of work which the men are required to do under the new regulations. They will be accompanied by the men's leaders. The process of gas making was continued on Saturday and Sunday. Commencing at eight o'clock in the morning, the clerks, whose numbers had been augmented by a few who desired to "have a turn," kept at work until about ten in the evening. On Sunday, they resumed at nine in the morning, and ceased about three in the afternoon. The retorts at Meadow Lane and York Street were kept going on Sunday; the men being paid at the rate of time-and-a-half for their labours.

In accordance with the resolution come to on Saturday, four machine men, eight firemen, and nine attendants commenced work in West's retort-house. These 21 men will have to do the work which 26 men were doing last Wednesday; and upon their experience during the next few days everything depends. If they find they can do the work, they will protest no more; and the dispute will be at an end. They will make no further demand on the Committee to increase the number of attendants per shift. If, on the other hand, they come to the conclusion that the new regulations are unreasonable, they will ask the Committee to amend them. If the Committee have it proved to them that they are requiring too much work from the men, they will doubtless consider the advisability of amending the rules in certain respects. The only danger lies in the possibility of the Committee and the men disagreeing as to "what constitutes a reasonable amount of work."

ELECTRIC LIGHTING NOTES.

The Oldham Corporation Electric Lighting Committee have agreed to modify their charges for electrical energy to 4½d. per unit for the first two hours, and 3½d. per unit afterwards.

The Ashton-under-Lyne Town Council are making application to the Local Government Board for sanction to the borrowing of £34,500 for the construction of electric lighting works.

The Morecambe District Council have forwarded to the Local Government Board detailed estimates of the cost of the plant required for their proposed installation of the electric light, and have asked for their sanction to a loan of £26,000 to carry out and complete the works.

It is proposed to extend the plant at the Wolverhampton Corporation electric lighting works, so as to make it equal to an additional 4000 8-candle power lamps; the estimated cost being £7830. This sum will have to be borrowed, together with £882 overspent on capital account in respect of the original outlay of £30,000.

The Carlisle City Council have resolved to carry out the scheme of electric lighting proposed by Professor Kennedy, and noticed briefly last week. The cost, it is estimated, will be well within £25,000. It is intended to light the streets in the centre of the town, in order, it is stated, to help to show the citizens the benefit of the electric light.

The annual accounts of the Stafford Corporation Electric Lighting Department have been issued. Excluding repayment of loans and the payment of interest, there is a profit of £601. The capital charges are £903; so that there was only a deficiency of £301. But last year a sum of £296 was carried forward—making a credit balance of £988, or only about £5 short of the total expenditure.

Electric lighting extensions are proposed by the Cheltenham Corporation, at an estimated cost of £3515. Since December last, the number of customers for the electric light has increased from 127 to 144; and the lamps wired, from 7500 to 9650. In addition, there are applications for 1000 lamps still waiting to be wired. The receipts for the year ending March 25—the first completed year of the undertaking—were a little more than sufficient to cover the working expenses; while this year they are expected to cover interest on capital.

In order to give effect to their recent determination to employ the electric light in the illumination of the streets, the Exeter Corporation have given notice to the Gas Company to terminate the present contract for street lighting. When the question was under discussion a month or two ago, it was suggested that the Corporation ought to take this course so that they might have a free hand with regard to street lighting when the electric light undertaking was extended. Since then the Electric Lighting Committee have come to the conclusion that the resources of the present works are equal to the lighting of the principal streets and the heads of certain of the cross streets. At the suggestion of the Committee, the City Council recently decided to exempt this portion of the city from any new arrangement with the Gas Company.

A short time ago, the Corporation of Hastings, sitting in Committee, passed a resolution to acquire the undertaking of the Electric Light Company for £58,000; and at the meeting of the Town Council next month, this resolution will doubtless be confirmed. The Council will then find themselves in possession of a new business which they will have to conduct to the satisfaction of the ratepayers. It is recognized by the local Press that it would have been something more than a mistake on the part of the Local Authority to establish works of their own, as it was at one time thought they would do. When they are in full possession of the plant, they will be expected to supply their product at a lower rate than the Company whose place they have taken. No doubt seems to be entertained that they will succeed in doing this; but time will show.

The Corporation of Plymouth have entered into contracts amounting in the aggregate to £35,031 for plant required for the equipment of their electric lighting undertaking. The tenders were presented under nine separate heads. The largest amounts are £13,401 for steam alternators, dynamos, &c.; £7757 for boilers, steam-pipes, &c.; and £6963 for underground cables, &c. Some criticism has been offered by correspondents of the local newspapers of the action of the Committee in passing over the lowest, and accepting higher tenders. If the lowest tender had been accepted in every case, a saving of £2692 on the contract price of the undertaking might have been effected; the greater portion being upon the contract for the alternators and dynamos. Mr. J. Willoughby, the Chairman of the Committee, dealt with the insinuations of the critics in a speech at a recent Town Council meeting. The explanation was, of course, that the Committee were satisfied that the extra cost would provide a better article. The Council evidently deemed the explanation sufficient; for they adopted the recommendations of the Committee without questioning any of the items.

"Free wiring" systems are capable of extensive modification. In response to their recent advertisement, the Torquay Corporation received three proposals. One was rejected because the authors of it required a monopoly of fitting up installations in the borough; while a local firm, who submitted alternative schemes, were willing to carry out either without this condition. Under one of these systems, it was proposed to charge 1s. 10½d. per quarter for each lamp of 32-candle power or under; the charge to include free lamps and maintenance, and the installation to become the property of the consumer at the end of seven years. It was urged that under this system the "long hours" consumer was encouraged; and that when the cost of lamp renewals and general maintenance was deducted, the charge worked out to less than ½d. per unit consumed for rental and the purchase of the installation. Mr. Threntham, the Corporation's Consulting Electrical Engineer, pointed out that the system, though it might commend itself to consumers who owned houses or had long leases, was not favourable to tenants with short ones. He was therefore more in favour of the same firm's alternative proposal, which was also on the hire-purchase plan, but based on a rental of ½d. per unit supplied, with a minimum charge of 1s. 6d. per lamp per quarter. This also included the renewal of the lamps and the purchase of the installation in seven years. The Electric Lighting Committee approved of the second plan; and the Council, on the Committee's suggestion, decided to recommend intending consumers to adopt it.

In order to reduce the difficulty caused by the inadequacy of the present electric lighting plant, the Cape Town Corporation have ordered a new set of engines and dynamos, capable of furnishing energy for an additional 6000 lamps of 8-candle power actually burning. This represents an increase of about 60 per cent. on the present output, and will, it is estimated, enable the Corporation to meet the immediate demands of consumers for more light. In connection with the additional motive power it is intended to supplement the existing trunk line by an overhead line, and to alter certain portions of the network to the three-wire 440-volt system, and supply consumers at double the existing pressure. Messrs. C. Proctor Banham and J. Denham, who respectively fill the posts of Electrical Engineer to the Table Bay Harbour Board and Electrician to the Cape Government Railways, were consulted by the Electric Lighting Committee as to the effect of these measures. Generally, they approve of the further employment of steam power, as tending to render the supply independent of the accumulators, and as giving an additional service at an earlier date than it could otherwise be obtained. They, however, point out that the system of maintaining a pressure of 220 volts between all wires of opposite polarity on the consumers premises is comparatively new and untried, and has the effect of increasing the risks from fire; while they condemn the overhead wire, and only approve as a temporary measure of the addition to the generating plant at the present station, which is at a distance from the town, and was erected to take advantage of water power, because of the expense of carting coal to it. However, the Corporation are going on with the scheme; the only alternatives to which are to let the works remain as they are in a state of arrested development, or, as one of the members of the Committee said, to relay almost the entire works, and undo nearly all they have done.

Reductions in Price.—The Burton Latimer Gas Company have reduced their price from 4s. 10d. to 4s. 7d. per 1000 cubic feet; and the Haslemere Gas Company have lowered theirs from 5s. to 4s. 7d.

Sales of Shares.—At Kirkham, Mr. R. Cross recently offered for sale several lots of the Fylde Water Company's stock. Two £25 lots of "A" stock sold for £88 each; and one of £20, for £64. Five £50 lots of "B" stock changed hands at £113 each; and £51 worth went for £115 15s. Last Wednesday, £5000 of new ordinary stock of the New Swindon Gas Company, on which a dividend of 10 per cent. has been paid for many years, was sold by auction; the prices realized being from £11 2s. to £11 11s. per £10 lot of stock.

PARIS GAS COMPANY.

The Report and Accounts for the Year 1896.

The following is an abstract translation of the report of the Directors of the Paris Gas Company for the past year, with the principal items in the accounts for this period.

The quantity of gas sent out last year for consumption in Paris and the 59 neighbouring communes served by the Company was 318,020,060 cubic metres, or about 11,226,110,000 cubic feet; being 6,996,660 cubic metres, or about 246,982,000 cubic feet, more than in 1895. The day consumption amounted to 96,967,470 cubic metres (3,422,952,000 cubic feet); being an increase of 2,736,930 cubic metres (96,613,629 cubic feet) on that of the previous year, and representing 30·49 per cent. of the total consumption. This augmentation of the day use of gas is attributable to its more extended employment for culinary, heating, and industrial purposes. The receipts amounted to 80,876,336 frs. (£3,235,053); or 2,118,621 frs. (£84,745) more than in 1895. Of the total, 74,052,429 frs. came from the city, and 6,823,907 frs. from the surrounding districts. The number of consumers on Dec. 31 last was 347,295, as compared with 319,153 on the corresponding date in 1895—an increase of 28,142. In that year, 37,936 consumers were added to the roll; making 66,078, or nearly one-fifth of the entire number, in the two years. This result is a striking testimony to the efficacy of the liberal measures adopted by the Directors in 1894 to encourage the use of gas. The number of burners in the public lamps on Dec. 31 was 93,044, of which 80,460 were employed in lighting the city, and the remainder were in use in the suburbs. The total is an increase of 2947 in the year. There was an addition of 401 recuperative lamps; bringing up the total to 3498. The number of rising mains fixed during 1896 was 3095, as compared with 2421 in 1895; making the total 42,980, fitted in 32,942 houses. There were at the close of the past year 216,585 consumers taking their supply from these mains; being 26,531, or 14 per cent., more than at the end of 1895, and representing upwards of 62 per cent. of the entire body. Twenty years ago—*i.e.*, on Dec. 31, 1876—the number was 26,805 only, or scarcely 23 per cent. of the total. So that there were added last year almost as many consumers of this class as there were upon the books at the date named. Comparison of the figures gives an idea of the change which has come about in the habits of the Parisians in the interval; and this change is unquestionably the result of the unceasing efforts of the Directors to increase the number of these rising mains, which convey the gas to the various storeys of the buildings. A very important step, which accounts to a great extent for the recent remarkable increase among this class of the Company's customers, was taken rather more than two years ago, when the Directors abolished all charges for the fitting, maintenance, and use of services and meters in the case of occupiers paying less than 500 frs. a year rent. This arrangement has been productive of excellent results; for from Aug. 1, 1894, to Dec. 31, 1896, it brought to the Company 71,830 new consumers, who last year burnt 16,500,000 cubic metres of gas, and added nearly 5,000,000 frs. to the revenue.

With regard to the works and plant, no important change was made in the manufacturing appliances at the various stations. Extensions of mains were, however, needed to meet the increased demands upon the Company. In the city, 16,861 metres, and in the suburbs 9246 metres of pipes were laid—making together 26,107 metres, or about 28,700 yards. This addition brought up the total length of mains at the close of the past year to 2,405,129 metres, or not far short of 1500 miles.

Turning to the section of the report devoted to the finances of the Company, we learn that a net sum of 5,375,245 frs. (£215,010) was expended last year for capital purposes, the larger portion of which was for rising mains, service-pipes, and meters. The capital account stood as follows on Dec. 31, 1896:—

	Francs.		Sterling.
Amount expended to Dec. 31, 1895	306,041,005	..	£12,241,640
Do. do. during 1896	5,375,245	..	215,010
Total	311,416,250	..	£12,456,650

To meet this there has been raised: By shares, 84,000,000 frs.; by bonds, 258,694,189 frs.—together, 342,694,189 frs. (£13,707,768). There is consequently a balance of 31,277,939 frs. (£1,251,118). The capital is represented by 336,000 shares and 553,332 bonds. Up to the date of the report, there had been redeemed 188,513 shares and 237,136 bonds; so that 147,487 shares and 316,196 bonds remain to be redeemed before the expiration of the concession in 1905.

The following is the working account for the past year:—

Expenditure.

	Francs.		Sterling.
Value of gas in store on Jan. 1, 1896	58,550	..	£2,342
Manufacture of gas—			
Coals carbonized	20,600,452	..	824,018
Coke and tar for heating purposes	4,228,106	..	169,124
Salaries and wages	4,945,519	..	197,821
Maintenance of works and plant	1,504,024	..	60,161
Incidental expenses of carbonization	1,301,322	..	52,053
Purifying materials and labour	335,086	..	13,404
Distribution—			
Salaries of engineers and officers	2,319,930	..	92,797
Repairs, &c., of mains and services	1,502,836	..	60,114
Miscellaneous expenses, stamps, &c.	530,675	..	21,227
General management (including interest and sinking fund payments)	24,156,828	..	966,273
Pension and provident funds	1,594,343	..	63,773
Municipal charges—			
Tax of 2 c. per cub. met. of gas sold.	5,470,188	..	218,807
Rent of subsoil occupied by mains, &c.	200,000	..	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality)	1,235,002	..	49,400
State charges—			
Official gas testing, stamps, &c.	1,095,721	..	43,829
Total expenditure	71,078,582	..	£2,843,143

Revenue.

	Francs.		Sterling.
Value of gas in store on Dec. 31, 1896	69,953	..	£2,798
Sale of gas	80,876,336	..	3,235,053
Residual products—			
Coke	12,230,670	..	489,227
Tar	2,325,218	..	93,009
Ammoniacal liquor	996,489	..	39,860
Rental of meters and fittings on hire	2,569,964	..	102,798
Fire-bricks, &c.	74,322	..	2,973
Interest and discount	836,694	..	33,468
Total revenue	99,979,645	..	£3,999,186
Deduct expenditure	71,078,582	..	2,843,143
Balance, profit for 1896	28,901,064	..	£1,156,043
Add balance of 1895 liquidation	195,241	..	7,810
	29,096,305	..	£1,163,853
Deduct to meet outstanding claims	296,305	..	11,853
Balance available for distribution	28,800,000	..	£1,152,000
Deduct for share dividend	11,200,000	..	448,000
Balance, divisible equally between the Company and the Municipality	17,600,000	..	£704,000

The total amount available for distribution among the shareholders is therefore as follows:—

	Francs.		Sterling.
Dividend as above	11,200,000	..	£448,000
Half of divisible balance	8,800,000	..	352,000
Placed to shareholders' credit, as per resolution of March 23, 1875	50,000	..	2,000
Balance of undivided profits	174,321	..	6,973
Total	20,224,321	..	£808,973
Deduct 1 fr. per share for reserve fund.	336,000	..	13,440
Balance	19,888,321	..	£795,533
Deduct interim dividend of 12 frs. 50 c. per share paid in October last	2,002,813	..	80,113
Balance available for final dividend	17,885.508	..	£715.420

The balance allowed of a further payment of 52 frs. 50 c. per share (£10); making in all 65 frs. per share, and leaving 245,509 frs. (£9820) to be carried forward. The Directors point out that the increased revenue enabled them not only to meet higher capital charges resulting from the last loan, but to compensate for the depreciated value of several of the residual products.

From the portion of the report dealing with the residuals, we learn that not only was the production of coke all disposed of, but that the stock was reduced by about 275 million bushels. The sales were 744,793 frs. (£29,792) higher last year than in 1895. Tar brought in 2,325,218 frs. (£93,009), as compared with 1,989,988 frs. (£79,600) in 1895; but the returns from ammoniacal liquor were only 996,489 frs. (£39,859), against 1,476,401 frs. (£59,056). So that there was a drop to the extent of 144,682 frs. (£5788) on these two important products, taken together. The cause of this was the depressed condition of the sulphate market.

The business in gas-stoves was fairly brisk last year. The Company sent out 1016 of these appliances of their own manufacture, and received orders for 6865 others of various makers. Their show-rooms were visited by 46,900 people; and the Company's outdoor agents called upon 8254 persons, at their request, to impart information on the right way of using gas for the purposes of lighting, heating, ventilation, and motive power. Lectures are given not only in the show-rooms, but in different parts of the city. One of the most important restaurants in Paris has lately installed, for culinary purposes, a large gas-heated oven made by the Company; and it appears to have given great satisfaction. It is expected that other establishments of this kind will follow the example. The sale of coke-stoves fell off last year to the number of 232 as compared with 1895.

The use of gas-engines continues to extend. Last year, 214 of these motors were put up; furnishing 957-horse power. The number in use in the area served by the Company is 2422, representing 8295-horse power. The quantity of gas used by these motors in the twelve months was 7,956,000 cubic metres (about 281 million cubic feet), or something like 2·5 per cent. of the total consumption. The utilization of gas as the motive power for working tramcars and lifts is now being seriously studied; and the Directors state that, as far as the trials have gone, they appear to have been satisfactory.

The report furnishes, as usual, full particulars in regard to the provident, pension, and other funds connected with the Company. No reference is made to the question of the price of gas; the matter now in dispute between the Company and the Municipality being the liquidation of the share capital. The Municipality have, however, placed at the disposal of the Prefect of the Seine a sum of 300,000 frs., out of the revenue from the supply of gas, to increase the salaries and wages of the Company's employees and workmen, in accordance with a decision come to by the Council in 1892. It appears that this decision puts upon the Company the obligation of appropriating twice the above-named amount to the same object. The Directors object to the Municipality taking the initiative in this matter, as nothing in the Treaty authorizes them to do so; but they have informed the Prefect that they will arrange for the disposal of the money in the most useful way. They therefore propose: (1) To fix at 5 frs. per day the minimum pay for workmen, without prejudice to the gifts of coke which they receive all the year round, and the bonus, amounting to about 35c. per day, which is assured to them by the 2 per cent. deducted from the profits of the Company. (2) To extend the help already given to the widows and orphans of employees and workmen who die before becoming entitled to a retiring allowance. (3) To inquire how far it will be possible to augment the number of year-end increases, having in view seniority, and the creation of a supplemental fund to provide, at the end of the concession, the higher pensions resulting from these increases. The first two propositions have been put into operation; but the third is under the consideration of the Directors.

BRUSSELS MUNICIPAL GAS SUPPLY.

The Gas Committee's Report on the Past Year's Working.

The Gas Committee of the Brussels Municipal Council have recently presented their report for the twelve months ending Dec. 31, 1896. They state therein that the total quantity of gas sold was 26,315,522 cubic metres, or about 928,938,000 cubic feet, as compared with 25,343,249 cubic metres, or 894,617,000 cubic feet, in 1895. It will thus be seen that the sale of gas continues to increase, notwithstanding the employment of incandescent burners and the competition of the electric light. This gratifying fact must be attributed, on the one hand, to the reduction in the price of gas, to the facilities afforded for fitting up new installations, and to the desire evinced by the consumers to constantly increase the amount of light they use; and, on the other, to the more extended adoption of gas cooking and heating appliances. The total production of gas reached 33,111,090 cubic metres (1169 million cubic feet); and it was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. and 13c. per cubic metre	22,206,892
Municipal establishments, at 10c.	927,702
Gas-engines, at 10c.	1,555,693
Industrial purposes, at 10c.	711,049
Heating purposes, at 10c.	353,190
Illumination devices, balloons, &c.	140,186
Artizans' dwellings and miscellaneous	420,810
Total sold.	26,315,522
Public lighting and illuminations	4,606,676
Used on the works, &c.	1,031,122
Unaccounted for	1,157,770
Total production	33,111,090

The total expenses amounted to 3,692,131 frs. (£147,685); the receipts, to 5,217,200 frs. (£208,688)—leaving a balance of 1,525,069 frs. (£61,003), as compared with 1,517,988 frs. (£60,720) in 1895. Allowing 83,424 frs. for the increased value of the stores, the profit resulting from the undertaking is brought up to 1,608,493 frs. (£64,340).

With respect to manufacturing operations, 113,364 tons of coal were carbonized; and 475 tons of oil were distilled for enriching purposes. The quantity of coke sold at the works was 739,058 hectolitres (about 2,032,410 bushels). The tar and other products were disposed of regularly; but, of course, the receipts from sulphate were affected by the low rates ruling. The breeze was utilized in the manufacture of 6968 tons of compressed fuel, which was employed in heating the retorts. A portion of the ash was sold for making mortar and for keeping up the roads. It is found particularly suitable for roads used for cycling purposes. A new purifying-house has been erected and a coke-breaker fitted up. The oil-gas plant has been duplicated, so as to be equal to a daily production of 38,000 (1,342,000 cubic feet) of gas.

The total amount of capital employed in the undertaking at the close of the year 1896 was 20,473,133 frs. (£818,925), as compared with 19,282,343 frs. (£771,294) at the corresponding period of 1895. Mains to the extent of 176,430 metres (194,073 yards) occupied the subsoil of the city at the close of last year, as compared with 169,716 metres (185,556 yards) at the end of 1895. The leakage amounted to 3·5 per cent. of the total quantity of gas sent out. The number of meters in use on Dec. 31 last was 20,102; being an increase of 2113 in the year. There were 622 prepayment meters fitted up. The consumption of gas by means of these meters is quite equal to the expectations of the Committee. Interior fitting work progressed well last year; 945 new orders having been executed. At the close of 1896, there were in use 4049 of these inside installations and 2141 rising pipes serving them. The gas-stoves on hire numbered 10,223; and 289 gas-engines, representing 1083-horse power, were doing useful work, principally in printing, lithographing, and bookbinding establishments. The Committee let on hire outside lanterns at rates which include the supply of gas and the maintenance of the lamp, which is fixed at the cost of the consumer. For a single-burner lamp the charge is 50 frs. per annum; for a five-burner lamp, 100 frs. At the end of last year, 17 of the former and 125 of the latter lanterns had been placed. For the public lighting, there were employed 5666 lamps, of which 616 were fitted with high-power burners. The total number of hours of lighting was 3845. Between midnight and one o'clock in the morning, 598 high-power and 734 ordinary lights are extinguished.

THE WATER SUPPLY OF VIENNA.

Our contemporary "Engineering" lately devoted an article to the above subject, from which we make the following extracts. The water question is one which has been much discussed in the Austrian capital; and, though several concessions have been granted, the solution of the problem has not been arrived at.

The water which is now supplied to the 1,500,000 inhabitants of Vienna is excellent, but deficient in quantity. It suffices for domestic needs; but it leaves little for industrial purposes, for public baths, flushing the sewers, and watering the gardens and streets. The latter point was emphasized ten years ago by the Medical Officer, Dr. Kammerer, in whose opinion the dusty streets of Vienna are chiefly responsible for the alarming mortality from diseases of the respiratory organs. In Vienna, the death-rate is lowest in October, rises during winter, and decreases after April and May. In Berlin, where diseases of the digestive organs predominate, the mortality curve takes the opposite course. For many years, the Vienna medical men have advocated ample flushing of the streets as more rational and effective than disinfection.

Vienna would not appear to be unfavourably situated as regards water; the mighty Danube passing through the northern districts, and the outrunners of the Alps being close by, with the high Alps within 40 or 50 miles. If it were not so, some big scheme might have already been adopted. About three years ago, the Oesterreichische Ingenieur und Architekten Verein of Vienna resolved to start an independent inquiry to clear up the matter, as the opinions concerning the suitability and capacity of the various sources suggested differ widely. A Committee, consisting of seventeen members, was delegated, which, under the presidency of Professor von Böhm, held seven sittings to take expert evidence, discussed the evidence in 23 plenary meetings, and submitted the matter to Messrs. Pollack, Schurz, Wilhelm, Witz, and Freund, the Secretary of the Committee, to draw up a report. A copy of this report, agreed upon in 41 further meetings, has been forwarded to us; and we gratefully acknowledge the courtesy of our *confrères*. The volume, of 213 large pages, illustrated by nine plates, many diagrams, and 63 tables, forms a most valuable addition to our literature on water supply. The trouble which the Verein have taken—the whole work being voluntary—is indeed remarkable. No definite scheme was before the meetings, nor were technical details gone into. It was, in fact, pretty clear that there would hardly be sufficient material to afford definite evidence in favour of the one or other source proposed. But the report will greatly help to clear the situation and assist the authorities in making their decision; and the material compiled from the expert evidence of the hygienists, chemists, meteorologists, geologists, and mining and hydraulic engineers, as well as from standard works and authenticated reports, is worthy of close study. Forty questions were submitted to the experts. The volume contains the shorthand minutes of those meetings, some other memoranda, the report of the Sub-Committee, and a *résumé*.

The excellent water which Vienna is now drinking, and which is not on any account to be contaminated by the admixture of less pure water, comes through an aqueduct (about the old plant the book says hardly anything) from the Kaiserbrunn in the Höllenthal, a little more than 40 miles south-south-west of Vienna in a bee line, near the Semmering Pass, and the Stixensteinquelle in the Sierningthal. The Kaiserbrunn is 537 metres (1760 feet), the other spring 470 metres (1540 feet), and Vienna 105 metres (344 feet) above the level of the Adriatic Sea. Several other springs in that district are, or are to be, utilized. Since 1874, the minimum daily supply obtained from the first-named springs has once, in the winter of 1887, gone down to 137,758 hectolitres (1 hectolitre = 22·05 gallons). The united springs yield now a minimum of 530,000 hectolitres; Pottschach brings the minimum daily total up to 610,000 hectolitres. For the future, a minimum daily supply of 140 litres (1 litre = 0·22 gallon) per head is to be secured for the summer months; and 110 litres for the winter, when gardens and streets claim less water. If the population of Vienna continues to increase at the present rate, 3,360,000 hectolitres will be required by 1920 for the summer months; and provision is to be made for this quantity. The 140 litres per head per day include 60 or 70 litres for strictly domestic use. In 1893, the Chelsea Water Company furnished 176 litres per head daily; the New River Company, 149 litres. Some of the cities of the United States can afford a lavish supply at little expense—*e.g.*, Chicago, 530 litres; but they do not come up to the 650 litres which Modern Rome enjoys, thanks to Ancient Rome, its enterprise, public baths, and love of public display. In the next century, the Vienna aqueduct, which cost 14 million florins, will no longer be able to carry the mass of water needed. But water from the springs now tapped might become scarce long before that time; and the Committee, therefore, in case the Alpine works cannot soon be enlarged, recommend a distinction between potable water and service water—the latter to be taken from some source nearer the Danube Valley. Some engineers would have a threefold supply, using river water for flushing the sewers. The service water should also be pure, though never to be used for drinking and cooking. Most of the medical men strongly oppose this suggestion, as abuse of the service supply could not be prevented. How the double supply is to be taken into the buildings, the report does not say.

In the higher-lying Alpine springs, the range of variations in level is almost double that of the lower-lying springs. For this reason Herr Tschebull wishes to penetrate farther into the Alps, and to drain the Rax Alp, Schnee Alp, and Upper Mürz Valley by driving horizontal, or slightly inclined, galleries into the lower portions of the Trias limestone, which rises to 1500 metres and above, at an altitude of about 500 metres, where the limestone overlies the almost impermeable *Grauwacke*, in order to collect the water infiltrated through the limestone. This means proceeding in miner's fashion; only the water is here to be utilized instead of being turned away. Herr Tschebull considers that the slow infiltration, which must be relieved by subterranean outlets, guarantees a sufficient supply at all seasons. But as his statistics were not conclusive, the Committee do not express any definitive opinion regarding this otherwise promising scheme. Herr Tschebull further believes that the Pottschach pumping-station, where seven wells have been sunk since 1878 to supplement the supply from the high Alpine springs (Herr Tschebull's other scheme refers to Alpine underground water, though that water may be tapped at absolutely greater altitudes), might be enlarged by boring artesian wells.

The next much-discussed scheme concerns the Steinfeld—a plain slowly sloping down to the Danube, bounded by the Weiner Wald in the west and the Leitha Mountains in the east. The fundamental strata, probably tertiary, are covered by stones and pebbles varying much in size, with enclosures of sand, conglomerates, &c. The *Schotter* (rubble) layer attains a thickness of 130 feet; but at the one point, at Sollenau, where a borehole has been sunk to a depth of 228 metres, it has a thickness of only 20 feet. Altogether, 135 borings, some few of more than 140 feet in depth, but as a rule not more than 50 feet deep, have been made in recent years in the search for water. A good many rivers break from the Stonefield, among them the Schwarza, which, with the Pitten and others, makes up the Leitha, the Fischa, &c. The Stonefield, and especially the southern portion near Wiener Neustadt, 280 metres above sea-level, and Neuenkirchen, which lies 11 miles to the south-west and 110 metres higher, is, therefore, a powerful reservoir, which many, and more recently Mr. Minister, who has obtained a concession, have meant to tap. But the quantity available is difficult to determine. It is not known in how far the underground basin coincides with the surface area as limited by the watershed, and whether and to what degree the river and rivulets of the district have to be considered, apart from the underground water, and *vice versâ*.

The total quantity of rainfall has long been tabulated; but the quantitative relations between evaporation, surface off-flow, and underground water cannot be ascertained. The velocity with which the underground water moves through the various layers of pebbles has been derived from

direct experiments, from the spreading of the red colouring produced by sulpho-cyanide of potassium, from continued observations on the changes of level of the water in the many boreholes and wells, and in other ways. The resulting velocities, from 1·5 to 22 millimetres (0·06 to 0·87 inch) per second, differ too widely. Professor Heyne, whose expert evidence is most instructive, concludes from the peculiar level variations in the boreholes that there are different subterranean currents and basins, and that hence estimates as to the mass of water that the Steinfeld would yield, based upon observations made at certain spots, are more fallacious than his colleagues assumed. Calculations of capacity, based upon the maximum and minimum rise of the underground water, have proved unreliable. Professor Suess drew attention to a circumstance that would affect the underground circulation. When pebble and sand soil are cultivated, the manure applied charges the surface water with carbonic acid, so that bicarbonates pass into solution, which at some depth are re-precipitated, producing a hard crust. Such crusts have had to be blasted in Holland. In the Landes of South-Western France, crusts of bog-iron ore are forming at the depth of 3 feet; and the conglomerates embedded in the Stonefield are probably of similar origin. Systematic continued pumping on a large scale, combined with observations on the depression cone resulting in the underground water, would probably furnish the only means of ascertaining the mass of water available. This would be a somewhat expensive experiment.

For the service water supply, which has to provide also for hydraulic installations, other areas would be at disposal. There is first the Wienthal, the valley of the Wien River, mostly fine-grained sandstone, with conglomerates cemented by magnesia, limestone, and ferrous oxide, alternating in thin layers with marls and slates containing more or less limestone and clay. This formation is little permeable, and does not contain springs of any importance. On exposure to the atmosphere, the bluish, apparently firm, sandstone oxidizes and disintegrates into a yellow mud, which favours the growth of forests (Wiener Wald), but which is not permeable in the ordinary sense. Large reservoirs and filter-stations would be provided in this district; but that step would be the initiation of a double water supply, which some authorities strongly deprecate. There is, further, the Tulln basin of the Danube, above Vienna, which is not rich in water, and the Danube and March valleys below Vienna, the Marchfeld, and the left and right banks of the Danube, in which, under a crust of vegetable earth, irregular layers of finer sand and pebbles, loamy generally, occur in irregular fashion. Good water has been found in several basins. The yield is not sufficiently established; but it would probably meet all requirements. The utilization of the water of a canal which joins the Leitha to the Danube, passing from Wiener Neustadt to Vienna, is not recommended. The water is inferior, and would fail during the winter months.

The *résumé* pleads for further researches, especially as regards the capacity of the various supply areas suggested, and advises the adoption of a secondary supply, also of superior water, exclusively for watering the streets and gardens, for factories, &c., at any rate for certain—essentially the manufacturing—districts. The greater part of the city could then continue to enjoy the uniform supply of the excellent water from the Alpine springs for all purposes.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The discussion upon the alleged poisonous qualities of carburetted water gas, to which I referred last week as having been taken up in the Edinburgh newspapers, has been continued. The letters are mostly of an alarmist nature; but, so far, the Gas Commissioners have taken no notice of them. One of the writers has been Surgeon Lieut.-Col. Cayzer, of Liverpool, who is, as is well known, greatly exercised over the supply of carburetted water gas in his district. He repeats the arguments which he has made use of in the South. Another writer quotes Chambers' Encyclopædia on the subject. The article in that publication is a very lugubrious one; but it has to be remembered that it was written some years ago, when much less was known as to the behaviour of carburetted water gas under ordinary conditions of supply than is the case now. The writer suggests that an interdict against the use of the gas might be applied for. This looks to be rather too bold, for the Gas Commissioners are not obliged to supply coal gas. They may make their gas out of any substance they choose; and the promoters of an interdict might find it difficult to secure evidence as to the endangerment of life which would entitle them to succeed. At all events, newspaper correspondence of the shrieking order is not calculated to do much good to any party.

With reference to the proposed acquisition of the local gas-works by the Corporation of Saltcoats, the subject again came up for consideration at the last meeting of that body. Mr. S. B. Miller moved that negotiations for the purchase of the works be dropped, and that nothing be done with regard to the *plébiscite* till the Sheriff takes action himself. Bailie Miller seconded the motion. The Provost said that what he maintained all along was that the gas-works ought to be in the hands of the ratepayers, because it was a monopoly which pressed in the past, and would press in the future, sorely on the ratepayers of Saltcoats. It had been stated in public that Mr. Foulis came down to Saltcoats and valued the works at £10,200. This was not the case. He came at the request of the Commissioners, who asked him if they would be justified in paying £10,200 for the gas-works; and he said they would. They never asked Mr. Foulis to value the works; and he (the Provost) was sure that, if they had asked him to do so, Mr. Foulis would have been inclined to put a slightly higher value on them than the Directors. As he had himself said at the public meeting of the ratepayers, they would in the near future be out of pocket to the tune of £200. Notwithstanding the fear of some people in the burgh—he did not think it was entertained by many people in Scotland—that electricity would soon become a serious competitor with gas, he thought it would pay the burgh to purchase the gas-works. He dissented from the motion, and would move an amendment, if he could find a seconder, that the *plébiscite* be gone on with, and that they purchase the gas-works at a fixed sum, to be arrived at by mutual arrangement or by valuation. He cared not by what means they got the works; for he believed, and had done so all along, that they ought to be in the hands of the ratepayers. It might be said that he had stated at the ratepayers' meeting that he would not pay more than £10,200; but

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 928).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25*	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½*	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	108—111	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	9½—10	..	5 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102—105	..	4 15 3
200,000	5	12 Nov.	6½	Bombay, Limited	6½—7½	..	4 6 8
40,000	5	,,	6½	Do. New, £4 paid	5—6	..	4 6 8
380,000	Stck.	26 Feb.	12	Brentford Consolidated	287—293	+2	4 2 2
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	143—148	+5	3 7 7
159,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	25 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	197—202	..	4 4 2
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11½	British	56½—57½	..	3 18 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18—20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	9¼—10¼	+¼	5 17 1
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101—103	..	5 16 6
150,000	20	26 Feb.	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16—17	..	3 10 7
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	340—345*	..	3 18 3
165,000	,,	,,	10½	Do. New do.	252—257*	..	4 1 8
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150—155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	255—260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	215—220	..	4 10 11
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.,	317—322		4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	139—142	−1½	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	17½—18½	..	4 9 3
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	301—306	+1	4 3 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	110—114	..	3 10 2
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	308—313	..	3 3 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	145—150	..	3 6 8
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	210—215	..	3 9 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	307—312	..	3 4 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137—142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155	..	2 18 1
908,000	,,	,,	6	Do. 6 p. c. do.	207—212	..	2 16 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12—13	..	4 12 4

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	12 Nov.	10†	Imperial Continental	210—215	+1	4 13 0
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk ,,	104—107	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5¾—6¼	..	4 16 2
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	111—113	..	4 8 6
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107—109	..	4 2 7
541,920	20	12 Nov.	5	Monte Video, Limited	15—16	..	6 5 0
150,000	5	26 Nov.	8	Oriental, Limited	8¼—9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7¾—8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5—5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	104—109	..	5 10 1
250,000	10	30 Sept.	10	San Paulo, Limited	13⅜—14½	..	6 18 0
5,475,000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	141—144	..	3 12 11
—	,,	—	—	Do. Deb. Stk.	—	..	—
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,000	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	30 Dec.	10	Tuscan, Limited	14—15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	101—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	328—333	−2	3 3 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	175—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158—162	..	2 15 6
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	220—225*	..	3 2 2
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	164—169	..	2 13 4
393,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106—108	..	2 15 7
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	112—117	..	3 4 1
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	340—345	..	3 9 7
		,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	270—275	−2	3 9 1
406,200	100	,,	7½	Do. 7½ p. c. max.	220—225	−2	3 6 8
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares	420—425	..	3 1 1
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152—155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	155—160	..	3 15 0
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	150—155	..	3 17 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175—180	..	2 15 7
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148*	..	2 14 2
1,155,066	Stck.	11 Dec.	10	West Middlesex	310—315	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—168	..	2 13 7

† Next Dividend will be at this rate.

*Ex div.

he could not give any other answer. They could not expect him to say, in face of shareholders of the Gas Company who were sitting in the meeting, that he would pay £10,500. The Provost's amendment was not seconded; and the motion was carried unanimously. It was decided to intimate the decision to the Ratepayers' Committee.

A Dundee newspaper gives voice to the expectation that there will be a considerable surplus on the working of the financial year of the Corporation gas undertaking, which ends on the 30th inst. The writer is proceeding purely upon surmise; but he has the good sense to keep within the bounds of safety when he says that, whether the Council will be able to give a reduction in the price of gas will depend upon the nature of the contracts they may make. This is self-evident; and being so, it is more than likely that there will be no reduction. The present price is 3s. 3d. per 1000 cubic feet. Last summer the rate was reduced 1d. per 1000 cubic feet, and meter-rents were abolished.

The Arbroath Gas Corporation have been moved by their Manager (Mr. R. S. Carlow) to provide additional gasholder accommodation. One holder, of 44,000 cubic feet capacity, is old and done; and the proposal was to replace it by a telescopic holder of 100,000 cubic feet capacity. It was also proposed to telescope a larger holder, at present of 120,000 cubic feet capacity, thereby doubling its storage capacity, and raising the total from 224,000 to 488,000 cubic feet. The cost of the proposed works was about £3000. It was explained that, on account of the very great increase in the consumption of gas—which in ten years had risen from 44 to 53 million cubic feet, while there had been no enlargement of the holder capacity—it was found that the works were being conducted in a way not so profitable as might be. Mr. Carlow submitted a statement to his Committee, which showed the advantages to be gained by increasing the storage accommodation to be as follows: There was first the wages of three men for 18 weeks during the months of November, December, January, and February, at 26s. 10d. per week, £72 9s. The cooling down of the retorts necessitated the using of first-class cannel coal, whereas a lower class of coal would suffice; and 150 tons, at 8s. per ton, would give a saving of £60. The saving on coke for firing purposes while the retorts were hanging would be £25; tear and wear of retorts, £50; loss on average quantity of gas made per ton of coal carbonized, 170 cubic feet on 5015 tons, £116; loss through leakage from small gasholder, £25—total, £348 9s. The small gasholder would cost £1010; and the large gasholder, £1760—together £2770. Interest [on £2770, at 3 per cent., would be £83 2s., which, deducted from £348 9s., left a saving of £265 7s. The Corporation met on Tuesday to consider the proposal. At this meeting it was pointed out that, whereas in Arbroath the holder capacity was equal to 75 per cent. of the maximum daily make, in Glasgow it was only 69 per cent.; and the question was asked whether Mr. Foulis, a gentleman who was at the top of his profession, was at all likely to conduct his business on disadvantageous principles. This view, and the fact that the burdens in connection with the gas undertaking are increasing, sufficed to curtail Mr. Carlow's proposals in the meantime. It was finally agreed to proceed with the renewal of the smaller holder as proposed; and the question of whether the larger holder should be telescoped is to stand over until the smaller holder is completed.

The Town Council of Glasgow last week made an attempt to appoint the new Electric Lighting Committee which they have resolved upon; but the task seems to be more difficult than to outsiders it need be. The fact is there is a competition for place in it; and the competitors naturally wish to have their friends on the Committee. Mr. Maclay, who submitted the list of names to the Council, said the Special Committee who had selected them had had a difficult and somewhat invidious task; but, limited as they were to appointing only 17 members, they had done the best they could in the circumstances. Complaint was made that the north-western district was not sufficiently represented on the proposed Committee—a plausible plea, with probably something behind it—and after a long discussion, the subject was sent back to the Special Committee. The change in the *personnel* by the inclusion of north-western representatives, will doubtless have a bearing on the claims of one of the candidates.

The Forfar Gas Corporation had reported to them this week that the new photometer had shown the illuminating power of the gas supplied to the town to be of 23·5 candles. This was considered by the members to be satisfactory. In various towns there are numerous complaints that shortly after a street has been paved, it is broken up for the purpose of renewing or repairing gas, water, or sewage pipes which may be laid in it. In Forfar, it is proposed to re-pave East High Street; and in view of the street being put into a state of repair, the Manager (Mr. Forbes Waddell) was asked by a Committee to report on the advisability of having a new and larger main laid. This report was to the effect that to lift the present 2-inch main, and replace it by a 7-inch one, would cost about £120. When this report came before the Corporation, it was not accepted, but was sent back to the Committee. In the opinion of one of the objectors, it would not be possible to lift the existing main so that it could be relaid. This is very strange; and it will probably be shown to be a fallacy. But the interesting feature of the incident is that, notwithstanding the usual complaint that it is the officials who are to blame for the reckless interference with newly-laid streets, in this instance if a mistake be made it will not be the Manager, but the Corporation themselves, who will be responsible for it.

The Greenock Police Board had before them this week a report by the Gas Committee, on the subject of giving a reduction in the price of gas supplied for motive power. The tenor of the report was that inquiries having been made of the bodies supplying gas in Edinburgh, Glasgow, Aberdeen, Dundee, and Paisley, it had been found that in none of these places was a differential rate charged; and the Committee were of opinion that the subject would require very serious consideration before they could entertain the proposal to give a reduction. The question was, therefore, shelved in the meantime.

The annual inspection by the Town Council of Glasgow of the Corporation water-works has been fixed for the 10th and 11th of June. This date is earlier than is usual; the reason being that by the end of the month it is expected that the district will be overrun by holiday-makers, who may have been attracted to this country to see the Diamond Jubilee celebrations. The company are this year to inspect the tunnel which is being made at the Loch Katrine end of the new aqueduct. This is the last section to be completed of the new works.

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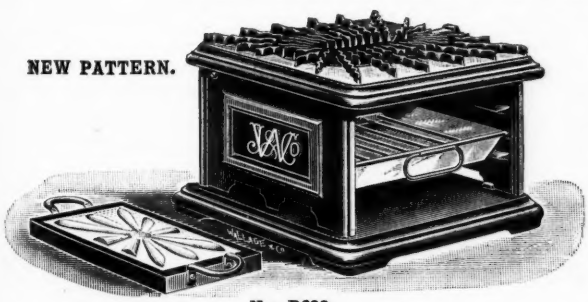
Suitable for use with PREPAYMENT METERS.

NEW PATTERN.



No. B632.

No.	Outside Dimensions.			Price complete with Pan and Grid and Special Deflector.
	Width.	Depth.	Height.	
B632	11	11	7½	12s. 0d.

This Griller is very strong; and there are no working parts to get out of repair. **Admirably adapted for letting out on hire.**

No. B628.

No.	Outside Dimensions.			Price complete with Pan and Grid.
	Width.	Depth.	Height.	
B628	12	8½	6½	6s. 6d.
B629	12	8½	6½	6s. 6d.

This Broiler is made entirely of **Cast Iron**, and is fitted with a very powerful Burner. Will cook two Chops, and boil a Kettle at the same time.

JOHN WRIGHT & CO., LTD., BIRMINGHAM and LONDON.

Yesterday the Edinburgh and District Water Trustees let the most important of the contracts in connection with the Talla scheme for the augmentation of the water supply—that for the construction of the embankment for the large reservoir on the Talla stream. The Works Committee reported that the three lowest offers sent in were: Mr. Thomas Peattie, of Bo'ness, £143,969; Messrs. James Young and Sons, of Edinburgh, £159,898; and Mr. John Best, of Leith, £164,675. In his report upon these tenders, the Engineer to the Trust (Mr. James Wilson) said it would be seen that the offers for the important part of the work—the formation of the embankment—were very close. The sum was about £62,000; and the difference between Mr. Peattie and Messrs. Young was about £2600. For road diversion, culverts, pipes, stone dykes, beaching and fencing, cleaning the bottom of the reservoir, and the like, there was more divergence; Mr. Peattie's offer amounting to £36,352, Messrs. Young's to £44,761, and Mr. Best's to £49,885. Ex-Bailie Archibald (Leith) moved the recommendation of the Committee, that Messrs. Young and Sons' tender be accepted. He said that they had eight offers lodged for the work, many of them from the most experienced contractors in Scotland and England. They knew that mere cheapness was not at all times a quality to be accepted as sound. The Talla reservoir was to contain 2750 million gallons of water; and it required the highest skill and greatest experience to secure a strong and substantial job. Messrs. Young and Sons had done work for the Trustees for 20 years in the most satisfactory manner; and they could be relied upon. Their estimate stood at £159,898 for the reservoir, and £3235 for a house and other buildings at Talla—together £163,133. Mr. Best's offer was £164,675 for the reservoir, and £3789 for the house—a total of £168,464, or about £5000 above that of Messrs. Young and Sons. Mr. Peattie's estimates were £143,969 for the reservoir, and £4070 for the house—a total of £148,039, or about £20,000 under those of Mr. Best, and £15,000 under those of Messrs. Young and Sons. Mr. Baxter (Leith) moved that Mr. Peattie's offer be accepted. In a discussion which followed, the remark was thrown out that good reason would require to be given for the giving of a bonus of £15,000 to Messrs. Young and Sons. In reply to this, it was said that the throwing of a wall across the Talla valley was a most important work, and one for which they required to get a responsible man—even at the cost of £15,000. By a majority of 14 votes to 4, the contract was let to Messrs. Young and Sons.

Gas Profits at Oldham.—The Oldham Corporation Gas Committee have decided to hand over to the borough fund for the relief of the rates a sum of £9102 from the profits of the year. Against this £2540 will be required from the rates to meet the expense of street lighting.

The Bradford Corporation and the Clayton Gas-Works.—The Gas and Electricity Supply Committee of the Bradford Corporation last Friday decided to take no further steps in the matter of the proposed purchase of the works of the Clayton and Allerton Gas Company. It was stated that the price fixed by the latter was so much in excess of what the Corporation proposed to give, that there was no prospect of any agreement being arrived at.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 24.

Sulphate of Ammonia.—The market has again been irregular; and prices accepted at different points have varied more than usual. Closing values are £7 10s. to £7 13s. 9d. per ton, delivered f.o.b. at the ports. There continues to be a good demand for home consumption. London has, however, participated in this less than other districts; and consequently it has been the weakest market, though low second-hand sales are reported to have been made elsewhere. There has been very little direct export demand. But a fair amount of "covering" of speculative sales has had to be done; and this has had the effect of steadying prices at Liverpool for April delivery. For May delivery, however, there are speculative sellers at a decline of 2s. 6d. per ton; but buyers do not seem in any hurry to avail themselves of these lower quotations.

Nitrate of Soda is unchanged; the quotations for spot stuff being 8s. per cwt. for good, up to 8s. 1½d. per cwt. for refined, quality.

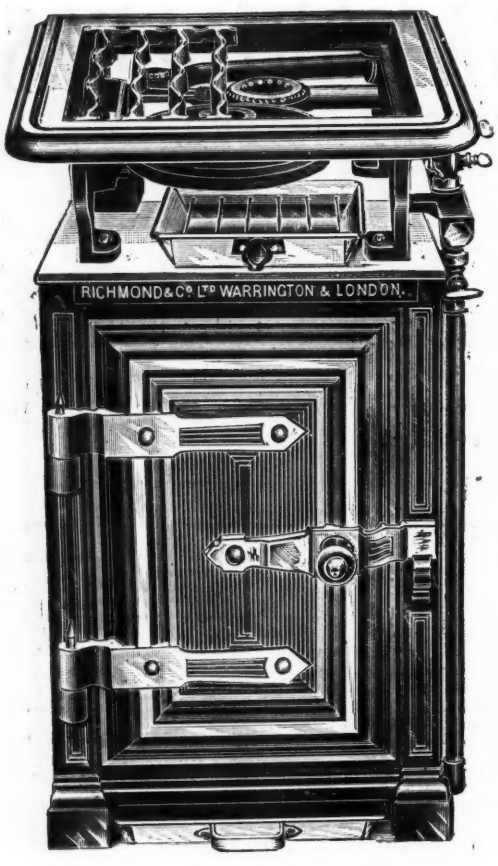
LONDON, *April* 24.

Tar Products.—The position during the week leaves but little to record in the way of change. The tendency of all the products, however, may be considered firmer as their rapidly decreasing make reduces the quantity of stuff offering. A fair amount of business has been done in benzols; and the numerous inquiries for toluol have had the effect of so increasing its value that to-day it is worth more than either 50's or 90's. A fairly good business has been done in anthracene, but at the low price recently recorded. The effect of the forced sales, however, has now passed; and improved prices are looked for. Inquiries for carbolic acid for the closing six months of the year are urgent; and business has been done for this period at as good a price as can be obtained for prompt. Pitch appears to have touched the bottom; and contracts have been closed for forward delivery at considerably above the recently quoted rates.

Prices are as follows: Tar, 15s. to 20s. Pitch, 21s. to 23s. Benzol, 90's, 2s. 3d.; 50's, 2s. 3d. Toluol, 2s. 6d. Solvent naphtha, 1s. 7½d. Crude, 30 per cent., naphtha, 1s. Creosote, 1⅞d.; liquid, 1¾d. Heavy oils, 37s. 6d. Carbolic acid, 2s. 5d. Naphthalene, 57s. 6d. Creosote salts, 25s. Anthracene, "A," 7d.; "B," 5d. to 6d.

Sulphate of Ammonia goes from bad to worse; and business has been done as low as £7 5s. To-day's price, however, may be taken as £7 10s., less 3¼ per cent. There seems no immediate prospect of improvement, unless it should emanate through the position being taken up by the leading manufacturers. It will be interesting to observe how far this is of effect.

Increased Receipts for Gas and Electricity at Bolton.—At a meeting of the Gas and Electric Lighting Committee of the Bolton Corporation on the 15th inst., it was reported that the receipts for gas in the financial year ending in March amounted to £149,637; being an increase of £6606 as compared with the previous year. For the supply of electricity, the receipts aggregated £5441, or £1317 more than in the preceding twelve months.



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COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—One or two small contracts for gas coal have been settled during the last week or so; but no very definite information is obtainable as regards the prices that have been obtained, except that they have not been below those ruling last year. It is reported that in one or two cases advances of about 3d. per ton have been secured. The weight of business done so far, however, is not sufficient to establish any reliable basis as to prices; and though most of the leading colliery owners are expressing a determination not to contract this season for gas coal unless they can obtain better prices than last year, the opinion which prevails in well-informed quarters is that, for anything like important contracts, it will be difficult to do much more than maintain the 1896 rates. In the general coal trade, a fairly steady tone is maintained; the holiday stoppages of the pits having caused an accumulation of orders at some of the collieries, which is keeping them fully going. Steam and forge coals are moving off pretty readily; but they are not more than steady at late rates. With regard to engine classes of fuel, the commoner sorts continue to hang somewhat upon the market, and could be bought at very low figures; but the better qualities meet with a ready sale, and supplies are not excessive, with the result that prices are strong at full quoted rates. At the pit mouth, 10s. to 10s. 6d. per ton remain the average figures for best Wigan Arley; 8s. to 8s. 6d., for Pemberton four-feet and seconds Arley; 6s. 6d. to 7s., for common house-coal; 5s. 9d. to 6s. 3d., for steam and forge coal. Common slack is readily obtainable at 3s. to 3s. 6d. per ton; and better qualities are quoted at 4s. 3d. to 4s. 9d. For shipment, a moderate business is reported; but it is exceptional where ordinary steam coal is fetching more than 7s. 6d. to 7s. 9d. per ton delivered at Mersey ports.

Northern Coal Trade.—There has been increased activity in the coal trade; for after the holidays there were stocks to be replenished, and the Baltic shipments are now commencing in earnest. The importance of the latter fact may be imagined, when it is added that to one port alone 1000 tons of coal are daily sent from the Tyne in the season. Best Northumbrian steam coals are firmer at from 8s. 6d. to 8s. 9d. per ton f.o.b.; second-class steam being about 8s., and steam smalls 3s. 6d. to 3s. 9d. Turns at the collieries are now rather long; but the output is a heavy one. Gas coals are more plentiful, because the deliveries to the companies in the south are at a lower rate; but there is the partial counterbalance of heavier exports. Prices of best Durham gas coals vary from 6s. 9d. to 7s. 3d. per ton f.o.b., according to quality and position of the collieries. Manufacturing coals show no alteration of moment, either in price or in the extent of the demand. Gas coke is unaltered in price; but heavy stocks are still held by some of the inland gas-works, and the household consumption is less than it was.

Scotch Coal Trade.—There is little change to record. Stocks are accumulating, both in the west and in Fifeshire; and, if anything, prices are tending to become easier—particularly for splint and steam coal. Ell is in good demand, both for home consumption and for export. The smaller varieties are in request, at unaltered prices. Quotations are: Main, 6s. 6d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. 3d.; and splint, 6s. 9d. to 7s. The shipments for the week amounted to 165,681 tons—an increase of 25,103 tons upon the previous week, and of 23,609 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 2,027,238 tons—an increase upon the same period of last year of 116,917 tons.

Extensions at the Blackpool Gas-Works.—The Corporation of Blackpool having applied for sanction to borrow £10,000 for gas-works purposes, Colonel A. G. Durnford, R.E., one of the Local Government Board Inspectors, held an inquiry in the town last Thursday. Mr. T. Loftus, the Town Clerk, explained that the Corporation borrowed £30,000 in 1877, at which time the output of gas was 46 million cubic feet, the rateable value being £98,122. In 1881, a further sum of £19,000 was borrowed; and the make of gas then was 145 millions, while the rateable value was £175,853. In 1894, when £50,000 was obtained, the make was 241 millions; the rateable value, £200,215. Now the output was 314 millions. The present sum was made up of £5210 for mains, and £3997 for meters; and the remainder was for lamps. There was no opposition.

The Gas-Works Purchase Question at Leamington.—In furtherance of the proposal to purchase the Gas Company's property, the Leamington Town Council have passed a recommendation of the General Purposes Committee that a duly qualified expert be engaged to report upon the condition of the gas-works and their value.

New Joint-Stock Companies.—The Company incorporated in 1891 under the title of Crossley Brothers, Limited, has been dissolved, and the undertaking acquired by a new Company, registered with a capital of £973,700, in £10 shares, who will henceforth carry on the business. The Dalry (Ayrshire) Gaslight Company was registered in Edinburgh last week as a limited liability company. The capital is £3538 10s., in 337 shares of £10 10s. each. The undertaking has been in existence since 1834.

Monte Video Water-Works Company, Limited.—The ordinary general meeting of this Company was held last Thursday, at the London Offices, Moorgate Street—Mr. F. S. Isaac in the chair. The Secretary (Mr. J. Anderson) having read the notice convening the meeting, the Chairman moved the adoption of the report, the principal portions of which were given in the "JOURNAL" last week. He said it might have been thought that the Directors could have proposed a higher dividend; but they considered it best to adopt a conservative policy, and strengthen the Company's position, especially in view of the present troubled political outlook, and the scourge of locusts in the country. Without prophesying, however, he thought he might express the hope that, when they next met, they would be able to pay a larger dividend. The excellent quality of the Company's water was shown by the low death-rate in Monte Video; it being only 14 per 1000 for the year 1895. With regard to their finances, the gross revenue had increased in the first quarter of the year by $2760, or about £587 sterling; so that the prospects seemed bright for the current twelve months. The thanks of the proprietors were due to the staff on the other side, especially to the Manager (Mr. Galwey) and the Engineer (Mr. Kirkwood) for the zeal they had displayed in forwarding the interests of the Company. The report was adopted, and the dividend declared.

Commemoration Festival of Messrs. Fletcher, Russell, and Co., Limited.—The Managing Directors of this Company gave their employees at Warrington and Pendleton a treat on Thursday, the 15th inst., in the shape of an excursion to the Belle Vue Gardens, Manchester, as a commemoration festival; the Scotia Works, Pendleton, having been opened for 21 years, and the Warrington works for 25 years. The wish of the Directors was that the people engaged in both works should become better acquainted with each other; and they adopted the surest means to attain this end by inviting all the employees, and also all their wives and children under 13 years of age, who were not engaged elsewhere. Each unmarried man not under 20 years of age had the privilege of taking a lady friend with him. The Pendleton contingent numbered 885; and that from Warrington, 430—making in all a party of 1315. The Warrington band led the way. The fares of the entire party, including admission to the gardens, dinner and tea, and other refreshments, were paid by the Directors. Mr. T. Fletcher, the Chairman of the Company, and other Directors and officials, were present. An interesting commemoration card gave a sketch of the progress of the undertaking; and Mr. Fletcher, in the course of a short address, stated that the Company's combined staff now numbered 645, whereas 25 years ago at Warrington it amounted to only one, who was present with them. An enjoyable day was spent.

Messrs. C. Isler and Co., artesian well engineers, have lately completed a well 200 feet deep for the Stourbridge Water Company.

Mr. R. Parkinson, of Peterborough, has obtained the contract for the construction of a covered service reservoir at Bawsey for the King's Lynn Corporation, for £4693.

The Directors of the Oriental Gas Company, Limited, have resolved to pay an interim dividend at the rate of 3½ per cent., free of income-tax, on account of the year ending the 30th of June next.

Messrs. R. & A. Main have lately held exhibitions of gas cooking and other appliances in the Public Hall, Alexandria, and in the Burgh Hall, Dumbarton; Miss Burden giving cookery lectures at each place.

Messrs. W. Parkinson and Co. held a successful gas exhibition from Wednesday to Friday last week in the Board Schools, Smethwick, with the assistance of Miss E. Sanderson as lecturer and cookery demonstrator.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

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ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

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Telegrams: "Volcanism, London."

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[For Illustrated Advertisement, see April 6, p. 804.]

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BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

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They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

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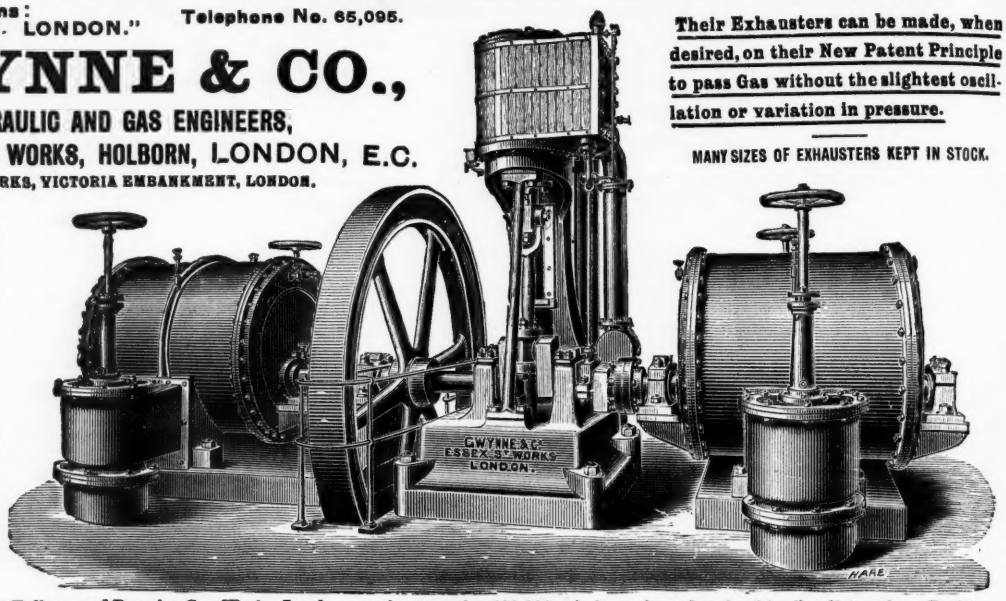

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Applicants should also state Age, and if Married, and if at present in or out of employment.
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Sono requisiti l' età non superiore ai 35 anni, la sana costituzione fisica, la buona condotta, la conoscenza della lingua italiana, studi e pratica corrispondenti all' ufficio, al quale i concorrenti aspirano, nonchè cognizioni teoriche e pratiche di elettrotecnica.

La definitiva nomina avrà luogo dopo un anno di buone prestazioni.

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April 21, 1897.

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One CAST-IRON SCRUBBER, 38 ft. 6 in. by 6 ft. diameter.

Two PURIFIERS, 8 feet square, complete, with 6-inch Bye-Pass Valves and Connections.

EXHAUSTERS, 5000 to 60,000 cubic feet per hour.

We would undertake to re-erect any of the above, if desired.

Photos, Particulars, and Prices of above on application to SAML. WHILE AND SONS, 60, Queen Victoria Street, LONDON, E.C.

HAMILTON CORPORATION GAS DEPARTMENT.

FOR SALE, complete—A Gasholder, 50 feet diameter (capacity 31,000 Cubic Feet), and One, 60 feet diameter (capacity 60,000 Cubic Feet).

Further Particulars may be had at the Gas Office, Portland Place.

WM. EWING,
Engineer and Manager.

Gas Office, Hamilton,
April 15, 1897.

FOR SALE—

Five 16-inch ROUND MOUTHPIECES, with Morton's Patent Lids.

Five 4-inch ASCENSION-PIPES to fit with

Five 4-inch SADDLES.

Two 6-inch FOUR-WAY CENTRE-VALVES.

Two 6-inch HYDRAULIC MAIN VALVES.

Apply to

C. H. DOWNS,
Secretary.

Gas-Works, Petworth, Sussex.

WARRINGTON CORPORATION.

(GAS DEPARTMENT.)

REMOVAL OF WORKS.

FOR SALE—18-in. by 14-in. ⌂, and 15- inch and 18-inch Round, MOUTHPIECES, HYDRAULIC MAINS, ASCENSION-PIPES, FURNACE FITTINGS, EXHAUSTERS, TAR-WASHER, 18-inch CENTRE and FOUR-WAY PURIFIER VALVES, 12-inch HYDRAULIC CENTRE-VALVE, METER (12-inch Connections), ENGINES, PUMPS, &c.

Apply for Particulars to Mr. W. S. Haddock, Engineer.

FREDK. TAYLOR, Secretary.

Gas-Works, Warrington.

COMPLETE GAS PLANT FOR SALE.

TO BE SOLD separately, or in one lot—

Two Double-Lift HOLDERS, 34 ft. 4 in. diameter outer, 32 ft. 10 in. inner, 14 ft. 8 in. deep, with Pipes, &c.

One GOVERNOR, SYPHON-BOXES, VALVES, &c.

One STATION METER, with Valves (new), Braddock's make.

One Set of four PURIFIERS, 7 ft. square by 4 ft. deep, Walker's make, with Grids and one of their Centre-Valves, Connections, and Lifting Gear.

One TAR-PUMP and STORE BOILER.

One "ECLIPSE" WASHER-SCRUBBER, Laycock and Clapham, with Pulleys and Governor, erected in 1890.

One EXHAUSTER, with 12-inch Valves and Connections.

One Horizontal CONDENSER, with fourteen 8-inch Pipes, 18 ft. long, with Bye-Pass, Valves, and Connections.

Twenty RETORT MOUTHPIECES, with Lids and Duplicates, Dip, Ascension, and Bridge Pipes, Hydraulic Main and Valve, Fire-Doors, Buckstaves, and Tie-Rods.

12-inch and 8-inch MAINS, at per ton.

12-inch VALVES, at each.

For further Particulars and Prices, apply to H. I. WILLIAMS AND CO., Kidsgrove, STOKE-ON-TRENT.

THE Directors of the St. Annes-on-the- Sea Gaslight and Coke Company, Limited, invite TENDERS for the supply of 2300 Tons per annum of screened or unscreened GAS COAL, to be delivered at St. Annes-on-the-Sea in such quantities as may be required during a period of One or Two Years.

Tenders, specifying the description of Coal, &c., are to be sent in on or before Thursday, the 29th of April, 1897, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM H. NUTTER,
Secretary and Manager.

Gas Offices, St. Annes-on-the-Sea,
April 14, 1897.

COUNTY BOROUGH OF STOCKPORT.

(GAS DEPARTMENT.)

TO GAS PLANT MANUFACTURERS & OTHERS.

THE Gas Committee are prepared to receive TENDERS for the supply and erection of a complete PLANT for the TESTING OF COAL.

Specification and full Particulars may be obtained on application to the Engineer, Mr. S. Meunier, Millgate, Stockport.

Tenders, endorsed "Test Plant," must be addressed to the Chairman of the Gas Committee, Portwood, Stockport, and sent in not later than May 5 next ensuing.

The Resolution of the Council that Contractors will be expected to pay the Standard Rate of Wages paid in the district, will apply to this Contract; and the Committee do not bind themselves to accept the lowest or any tender.

By order,
WALTER HYDE,
Town Clerk.

Stockport, April 23, 1897.

CORPORATION OF LEICESTER.

GAS COAL.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply of COAL, COBBLES, or NUTS (about 140,000 Tons per annum) for One or Two Years ending May 31.

Particulars and Form of Tender can be obtained on application to the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, May 8 next.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.

Offices: Millstone Lane,
Leicester, April 21, 1897.

TENDERS FOR GAS COAL.

THE Corporation of Droitwich invite TENDERS for the supply of from 1100 to 1300 Tons of best screened GAS COAL, to be delivered free at Droitwich (G.W.) Railway Station, at such times and in such quantities as may be required, prior to the 31st of May, 1898.

Particulars and Form of Tender may be obtained on application to the Manager of the Gas-Works.

Sealed tenders, on the form provided for the purpose (with the Analysis of the Coal to be supplied), endorsed "Tender for Gas Coal," to be sent to the undersigned on or before the 8th of May.

The Corporation do not bind themselves to accept the lowest or any tender.

S. JOHN TOMBS,
Town Clerk.

Droitwich, April 23, 1897.

ARBROATH GAS CORPORATION.

TO GASHOLDER MAKERS.

THE Arbroath Gas Corporation invite TENDERS for the Erection of a New TWO-LIFT TELESCOPE GASHOLDER.

This Holder is to be placed in a Stone Tank, already erected, 57 feet in diameter by 18 feet deep.

Other Particulars can be had from the Manager, Mr. R. S. Carlow.

Tenders, with Specifications and Tracings, to be delivered to the undersigned, not later than Monday, the 10th day of May next.

Parties tendering will not be paid for lodging Specifications and Tracings.

The Arbroath Gas Corporation do not bind themselves to accept the lowest or any tender.

ROBERT S. CARLOW,
Engineer and Manager.

Gas-Works, Arbroath,
April 22, 1897.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 4300 Tons of screened GAS COAL in Trucks at the Brentwood Railway Station (G.E.R.), at per ton, to be delivered in the following quantities the second week of each month: June, 140 Tons; July, 160 Tons; August, 300 Tons; September, 500 Tons; October, 550 Tons; November, 600 Tons; December, 560 Tons; January, 500 Tons; February, 350 Tons; March, 300 Tons; April, 250 Tons; May, 190 Tons.

Tenders, with Analysis of the Coal to be supplied, and Terms for Monthly Payments, to be sent to the undersigned on or before the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 10, 1897.

SOUTH SHIELDS GAS COMPANY.

TO COALOWNERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of 40,000 Tons of clean, unscreened GAS COAL, for delivery, into Craft, and at the Company's Depôt, South Shields as required, over a period of Twelve Months.

The Directors reserve to themselves the right of taking the Coal in one or more lots.

The lowest or any tender not necessarily accepted.

Particulars as to Deliveries, &c., may be obtained at the Gas-Works, on application to Mr. W. J. Warner, the Engineer.

Sealed tenders to be delivered to the undersigned, not later than Friday morning, the 7th of May next, endorsed "Tender for Coal."

J. H. PENNEY,
Secretary.

Gas Offices, Chapter Row, South Shields,
April 23, 1897.

BOROUGH OF BRIGHOUSE.

TENDERS FOR GAS COAL, CANNEL, AND LIME.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL and CANNEL and BUXTON LIME required at the Mill Lane and Birds Royd Gas-Works during the Year ending the 30th of June, 1898.

Specification and Form of Tender can be obtained on application at the Gas Engineers' Office, Public Offices, Brighouse.

Sealed tenders, stating price per ton delivered at the Gas-Works, or alongside Gas-Works, by the Calder and Hebble Canal, or at Brighouse Railway Station, must be sent in on or before Wednesday, the 5th day of May, 1897, addressed to the Town Clerk, Public Offices, Brighouse, endorsed on the outside "Tender for Coal, or Lime," as the case may be.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Town Clerk's Office,
April 21, 1897.

RAMSGATE CORPORATION.

(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of first class NEWCASTLE GAS COAL, in three annual quantities of 19,000, 20,000, and 21,000 Tons, delivered free into Carts on the Quay of Ramsgate Harbour.

The first quantity of 19,000 Tons to be delivered in equal monthly quantities between the 1st of July, 1897, and the 30th of June, 1898; the second and third Years' supplies also in equal monthly quantities between the 1st of July, 1898, and the 30th of June, 1899, and the 1st of July, 1899, and the 30th of June, 1900. A distinct price to be named for each annual quantity.

Tenders to be sent in not later than Saturday, May 1, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, endorsed "Coals."

The Committee do not bind themselves to accept the lowest or any tender.

Full Particulars and Form of Tender on application to

WILLIAM A. VALON,
Engineer.

BOROUGH OF CLITHEROE.

THE Gas Committee invite Tenders for the supply and erection of two PURIFIERS, with Covers, Wood Grids, Girders, and Lifting Apparatus, and two Four-Way Valves.

Specification may be seen, and all necessary Information obtained, at the Office of the undersigned.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Purifiers," to be addressed here not later than Saturday, the 15th of May next.

The Committee do not bind themselves to accept the lowest or any tender.

ROBT. BARRETT,
Manager.

Gas-Works, Clitheroe,
April 21, 1897.

LURGAN GASLIGHT AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 3000 Tons of the best quality (screened) GAS COAL, delivered into Lighters, *ex*-ship at Belfast, free of all Charges.

Delivery of 2500 Tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of April, 1898, as may be required. Vessels carrying from 200 to 300 Tons can at once deliver into Lighters; and these Lighters be back for a further Cargo within a period to be arranged and agreed upon by the Gas Company. Each Cargo must be accompanied by a Certificate from the Colliery Proprietors furnishing the Coal.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Eleven o'clock in the forenoon of Friday, the 30th of April, 1897.

The Directors do not bind themselves to accept the lowest or any tender.

FRED W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
April 6, 1897.

HINCKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

EXTENSIONS.

TENDERS are invited for the following APPARATUS to be delivered, erected, and put to work at the Gas-Works, Hinckley:—

1. ENGINES and EXHAUSTERS—Two Complete Sets of Engines and Exhausters combined, each for 20,000 cubic feet per hour.
2. BOILERS—Two Cornish Steam-Boilers of 12-horse power, complete, with Donkey Feed-Pump Injectors, and all necessary Fittings.
3. SCRUBBERS and LIVESEY WASHER—Two Tower Scrubbers, 55 feet high, 8 feet diameter, Spiral Staircase, &c., and a Livesey Patent Washer for 500,000 cubic feet per day.
4. PURIFIERS—Four Purifiers 20 feet square, 14-inch Connections, and Six Four-way Valves, Lifting Apparatus, &c.
5. PUMPS—Three Fly-wheel Steam-Pumps, Evans's make, for Tar, Liquor, and Fresh Water.
6. METER—One Station Meter for 20,000 cubic feet per hour, with 14-inch Valves and Connections.
7. GOVERNORS—One 15-inch Station Governor.
8. LABORATORY FITTINGS, &c. — Standard Photometer (Letheby-Bunsen System), with complete Set of Instruments and Fittings; Sulphate and Ammonia Testing Apparatus, &c.

Specifications and any further Information may be obtained on application to the undersigned.

No tender will be considered unless strictly conforming to the specifications.

The Contractor or Contractors will be required to enter into a contract and bond as security for the due performance of his or their contracts.

Sealed tenders, suitably endorsed, and addressed to the Chairman of the Gas Committee, Gas-Works, Hinckley, to be delivered at or before midday Monday, the 17th of May, 1897.

GEO. HELPS,
Engineer and Manager.

Gas-Works, Hinckley.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc M.Inst.C.E., F.C.S.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

200 SHARES IN THE
WORTHING GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in Lots, 200 £10 fully-paid SHARES in the above Undertaking, ranking for a Standard Dividend of 7 per cent. per annum; the last Dividend on similar Shares in the Company having been at this rate.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

500 SHARES IN THE
SOUTHEND WATER-WORKS COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Wednesday, May 26 (instead of May 3, as previously announced), at Two o'clock, in lots, 500 £10 SHARES (to be issued as fully paid) in the above Undertaking, ranking for a Maximum Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at the rate of 5 per cent. per annum.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

2000 SHARES IN THE
WEST HAM GAS COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Monday, May 10, at Two o'clock, in lots, 2000 £10 FULLY-PAID SHARES in the above Undertaking, to be issued under the Provisions of the West Ham Gas Act, 1889; the Dividends on these Shares rising or falling according to the Price charged for Gas. The last Dividend on the Company's £10 Shares was at the rate of 6½ per cent. per annum.

Particulars of the SECRETARY of the Company, at the Offices, STRATFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late William Charles Barnes, Esq., and other Executors and Owners.

GAS AND WATER STOCKS AND SHARES
AS FOLLOWS:—

Chigwell, Woodford, and Loughton Gas Company—£1200 Stock, 379 £10 Shares, and £50 Debenture.
Commercial Gas Company—£531 Stock.
Harrow and Stanmore Gas Company—58 £10 Shares.
Portsea Island Gaslight Company—12 £50 Shares.
Cromer Gas and Coke Company, Limited—40 "A" Shares.
Godstone District Gas Company—60 Shares.
Horley District Gas Company—80 Shares.
Guernsey Water-Works Company—100 £10 Shares.
Epping Gas Company, Limited—Two Shares.
Clacton-on-Sea Gas and Water Company—80 Shares.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CASES FOR BINDING
VOLUMES OF THE "JOURNAL"
(GREEN CLOTH, GILT LETTERED)
MAY BE HAD FROM THE PUBLISHER
Price 2s. each.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

THE "COOMBE" DRAUGHT SCREEN
FOR INCANDESCENT BURNERS.
For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," April 6, p. 802.
ALFRED ARCULUS & CO., Glass Manufacturers,
BIRMINGHAM.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON, FITTER.

EVESON FOR CANNEL

TELEGRAMS:
"EVESON, BIRMINGHAM."

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

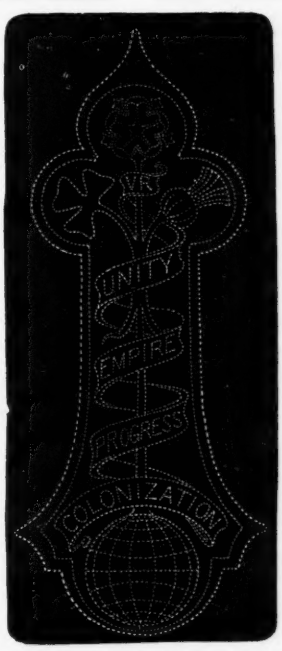
Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

GAS ILLUMINATION JUBILEE DEVICES.

ORDER EARLY



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PRICE LISTS ON APPLICATION

JAMES MILNE & SON

— LIMITED —

EDINBURGH, LONDON, LEEDS AND GLASGOW.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

EXTRACTION APPARATUS
SPECIALLY DESIGNED
TO EXTRACT THE SULPHUR FROM SPENT OXIDE.
BUILT BY
WEGELIN & HÜBNER, HALLE a/S.
ENGINEERS AND IRONFOUNDERS.

LATEST
Improvements in Sulphate of Ammonia Apparatus
COLSON'S PATENT)

EXTRACT FROM ENGINEER'S REPORT: "I can now obtain **60** Tons of Sulphate of Ammonia per week with 'Colson's' Still, using ONE Boiler, whereas, with my former continuous plant, TWO Boilers were required to produce **40** Tons per week."

EXTRACT FROM LETTER: "As regards the consumption of Lime, I may say that we work with **40** per cent. LESS than on the old system. Of the principle and workmanship of the Stills, I can speak very highly. When once working, we find them very silent, automatic, and requiring very little attention. As for the cleaning out of the Stills, we find they only require doing so once in Six Months; and this can be accomplished in **24** HOURS AGAINST **3** OR **4** DAYS with the old style of upright Stills." WILFRID WYLD, Bradford Corporation Chemical Works.

For Prices and Particulars, apply to the Sole Makers—
ASHMORE, BENSON, PEASE, & CO., Limited,
Gas-Works Contractors, STOCKTON-ON-TEES.

INCANDESCENT STREET LIGHTING.

THE ONLY SUCCESSFUL ECONOMICAL AND EFFICIENT
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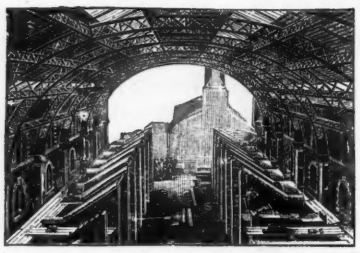

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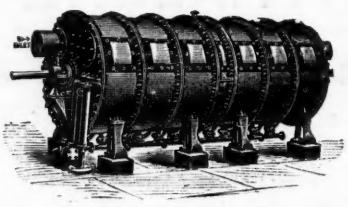

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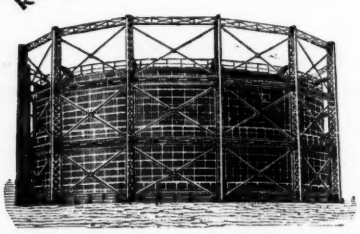

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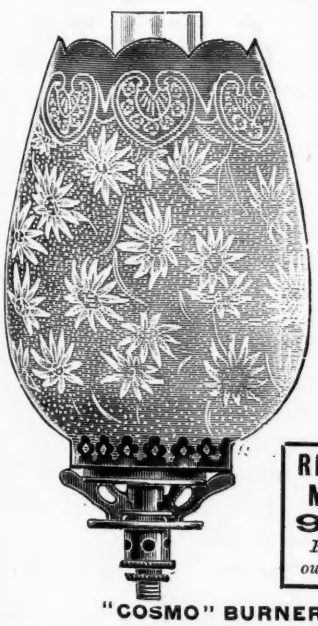

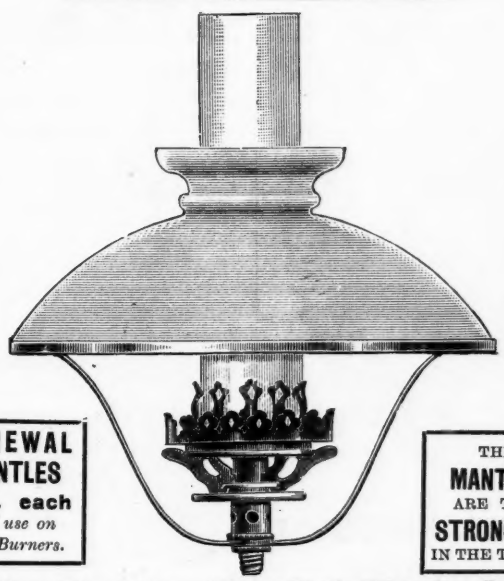

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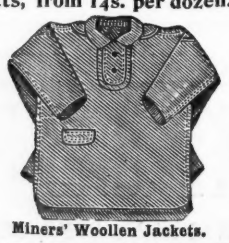

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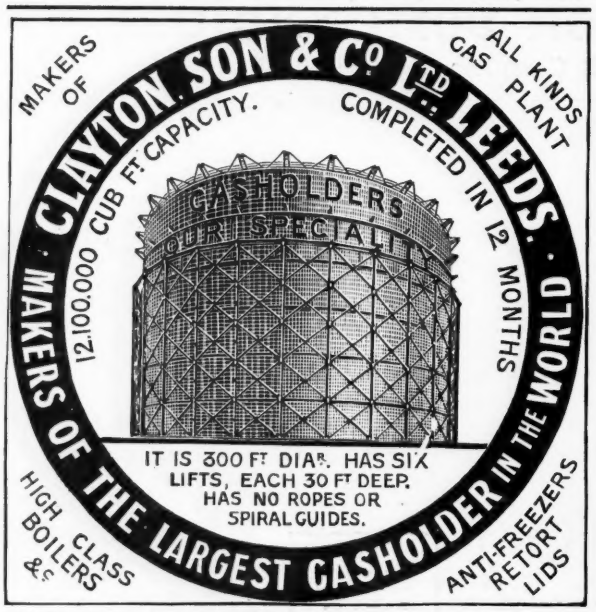
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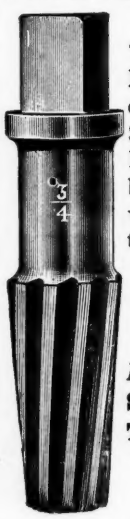

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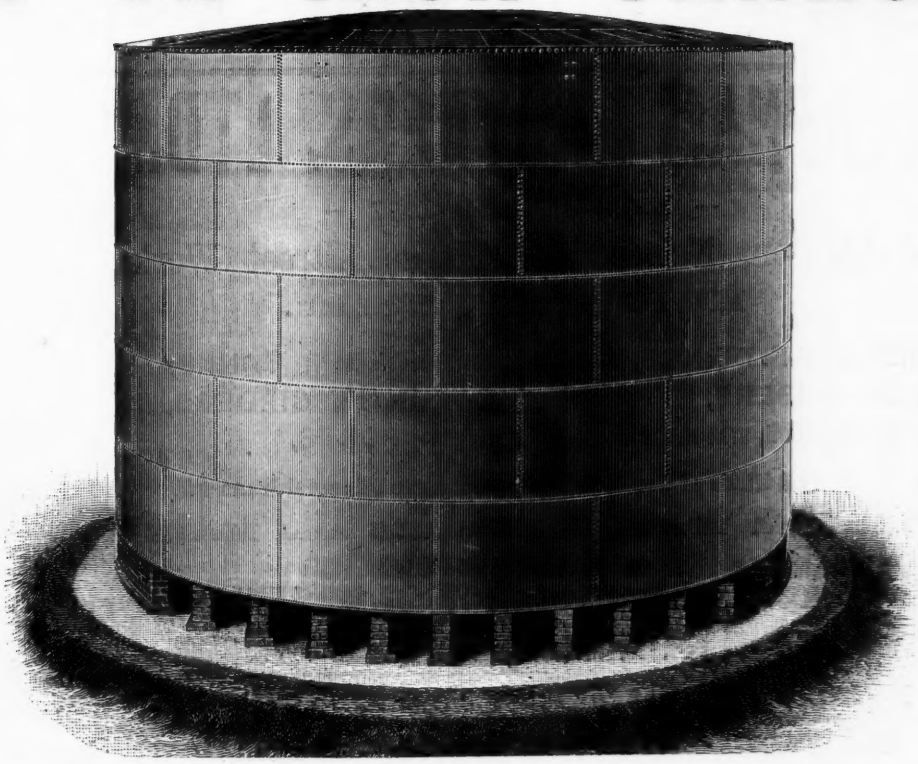

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